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THE USE OF PROPYLTHIOURACIL IN HYPERTHYROIDISM

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NOT since 1922 when Plummer announced the use of Lugol's solution in the treatment of hyperthyroidism has so much interest in this subject been occasioned as by the discovery of thiouracil and propylthiouracil.

Early experience with thiouracil seemed to offer great promise, but more prolonged studies pointed out several disadvantages. The principal objection to this drug is its high degree of toxicity, reports in the literature listing over 25 deaths resulting from agranulocytosis. Numerous less serious reactions, such as skin eruptions, gastrointestinal upsets, headache, and vertigo, likewise cause it to be objectionable. While certain cases of exophthalmic goiter showed a nearly favorable response to the drug, when it was withdrawn in others, a high percentage sooner or later relapsed and symptoms of hyperthyroidism recurred. Three years' clinical research on 50 cases of toxic goiter convinced me that thiouracil would not replace thyroidectomy.

In January, 1946, a new and far less toxic drug, propylthiouracil, became available for clinical investigation, and since that time I have discontinued the use of thiouracil, although fortunately I never encountered any serious reactions with that drug.

From preliminary reports of Drs. Edwin Astwood and Willard

The Frieda Meyers Nishan Foundation for the Study of Goiter of the Jackson Clinic.

Material for this study was furnished by Dr. Stanton M. Hardy, medical director of the Lederle Laboratories Division, Pearl River, N. Y., and by Dr. K. K. Chen of Eli Lilly and Company, Indianapolis, Ind.

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Vanderlaan, of the Joseph Pratt Diagnostic Hospital, Boston, as well as those from the Cleveland and Lahey Clinics, and from our own observations, these seems little doubt but that this new drug will prove very effective in the treatment of hyperthyroidism.

The thyroid surgeon has, with the aid of Lugol's solution, fairly well solved the problems confronting him in recent years with the following exceptions: the extremely toxic case of exophthalmic goiter with a very large friable gland; the same disease in the young and the aged, or when complicated by other diseases; the so-called "iodine-fast" group that have received iodine so long they have developed a tolerance to the drug; and, finally, the patient with advanced toxic adenomata, suffering from such conditions as decompensation, auricular fibrillation, hypertension, senility, liver damage, and diabetes. All of these types of cases still offer a surgical risk considerably greater than the average case of exophthalmic goiter or toxic adenoma.

It is in just such cases as these that propylthiouracil is proving effective. How permanent this effect will be, time alone will tell. Certainly no definite conclusions can be formulated as to its curative results until a considerably larger series has been studied over a much longer period of time. Probably by the end of the present year we can conjecture with some degree of certainty as to its ultimate action in exophthalmic goiter. One cannot, of course, ever expect that this or any other drug will cure toxic adenoma, since surgery will eventually be required to remove the tumor. Yet, if the bad risk cases of this type can be so improved that thyroidectomy may be performed with approximately no greater risk than in the nontoxic type, this drug will indeed prove a great boon to the surgeon.

Likewise, propylthiouracil gives us a chance to rest the "iodine-fast" case of exophthalmic goiter and curtail the need for a two-stage operation in this bad risk group. As yet I have not operated upon any children suffering from this disease who have received this drug. At the present time I have 4 children all under 14 years of age who are receiving propylthiouracil. One 11 year old child has now been on the drug for nearly a year, having been changed over from thiouracil. The improvement in her case has been remarkable. At first she had a basal metabolic rate of +41 per cent; the rate steadily dropped until it has now been below zero for several months. The pulse rate has decreased from 140 to 90, and she has gained 12 pounds and been able to return to school. Whether or not the disease will recur when the drug is withdrawn

remains to be seen. When she has been on the drug a year, it will be withdrawn to observe the permanency of its effect.

In another child 9 years of age who showed a similar favorable response for several weeks, the white blood cell count fell to 2,500 after she had taken but 75 mg. a day for 6 weeks. After a rest period of 2 weeks on iodine, propylthiouracil has been resumed again. In two other children there has been an excellent response to therapy and all symptoms of hyperthyroidism are controlled.

In the 70 cases I now have had under observation there has not been a uniformity of results in treatment. This may be explained by the fact that other investigators, as well as myself, hesitated to subject their patients to any unnecessary risk after the unfortunate record of thiouracil therapy. A year ago we began by using small doses, such as 25 mg., three times a day. Gradually this dosage has been increased until McCullagh recently reported that he had now raised the dose to 200 or even 300 mg. per day if a prompt response is not obtained. Astwood has advocated a daily dose of 100 to 150 mg., while Bartels of the Lahey Clinic is now using 100 mg. twice a day. We have not yet standardized our dosage of the drug but have tried to fit the amount to the individual case. We have used somewhat smaller amounts for children, while in the "iodine-fast" type a larger than average dose has been given. Most of our patients are now receiving 50 mg. three times a day.

As yet no toxic manifestations of the drug have been observed in our series with the exception of the case previously mentioned in which the white blood count fell to a dangerous level.

In a personal communication received on Feb. 7, 1947, Bartels stated that he had now treated 370 patients for thyroidectomy with propylthiouracil and that he had 60 more under treatment. In the entire group 6 reactions occurred. One of these was a definite fever reaction similar to that observed with thiouracil. A small dose caused a return of the fever. Five patients showed significant changes in the blood.

Bartels believes that propylthiouracil is not a curative drug in exophthalmic goiter. He thinks there is little question but that it will produce a prolonged remission in patients who have mild hyperthyroidism with a small gland, similar to that obtained with iodine. Since it does not alter the size of the gland or restore the gland to normal, he believes there is little hope of obtaining a permanent cure. Probably Bartels with his large experience is correct in this assumption. However, the excellent results I obtained with thiouracil in some cases of exophthalmic goiter, in particular the

recurrent type, lead me to hope that a cure may be obtained in certain patients without resorting to surgery.

In another communication received Feb. 11, 1947, from Stanton Hardy, director of scientific research at the Lederle Laboratories, data was furnished on 824 individual case reports submitted to him on patients treated with propylthiouracil. Hardy believes that at present the initial dosage of the drug must be between 125 and 250 mg., with the maintenance dose a highly individual matter but considerably less than the original amount given. He estimates that as of the above date about 1,500 cases have been treated with propylthiouracil. He states that a few toxic reactions have been repored which have been almost entirely of a minor character and very few necessitated the discontinuation of the drug. Further, he reports that, so far as he knows, there have been no fatalities of any sort in connection with the use of the drug, and it certainly seems that there is no comparison between its safety and that of the infinitely more dangerous thiouracil, which will be withdrawn as soon as propylthiouracil can be made commercially available. Hardy is not willing to hazard an opinion at this time as to whether or not this agent will prove curative in exophthalmic goiter.

These opinions express the views of the two men who at present probably have the most information about this intriguing new drug.

From our experience it has not seemed necessary to observe as careful precautions as when one is using thiouracil. We are now routinely having a white blood cell count taken every third week. Only one count has been observed to fall below 5,000, which we consider the low limit of safety. No skin reactions, fever, gastrointestinal upsets, or other toxic manifestations have been observed in our study. Yet when I visited the University of Michigan School three weeks ago, the men there seemed to feel that large doses of this drug might prove as dangerous as thiouracil.

Every physician and surgeon is anxiously awaiting the release of propylthiouracil, but before this can occur, it must first receive the approval of the Council on Drugs of the American Medical Association. In my opinion it was a mistake to release thiouracil in January, 1946, as I believe more harm than good has resulted from its widespread use. Recently I heard of a fatality from agranulocytosis occurring in a case of suspected hyperthyroidism, that was actually one of neurocirculatory asthenia, treated with thiouracil. Then, too, the diagnosis in many questionable cases has been confused just as with the prolonged use of iodine. Consequently, it is hoped that when and if propylthiouracil is released for general

distribution to the medical profession it will have been definitely proved to be far safer than its predecessor, thiouracil.

The more quickly a decision is reached to withdraw thiouracil and replace it with propylthiouracil, the better it would seem to be for the safety of our people.

That this drug will prove to be a most valuable aid to the surgeon interested in thyroid surgery seems evident from our present knowledge. It is possible that it will go a step further and prove to be curative in exophthalmic goiter, at least in certain cases. It will undoubtedly supplement but not supplant thyroidectomy in general in the treatment of hyperthyroidism.

Conclusions

A preliminary report of a study of 70 cases of toxic goiter treated by propylthiouracil is presented; from this study and from a study of the results of other observers, involving possibly 1,500 cases, the following conclusions are drawn:

1. Propylthiouracil has definitely replaced thiouracil as a safer and more effective drug in the treatment of hyperthyroidism.
2. Since propylthiouracil does not alter the pathology of exophthalmic goiter, it seems questionable whether or not it will prove curative in this disease.
3. Studies so far offer the hope that in early, in mild, and in recurrent, cases of exophthalmic goiter propylthiouracil may prove curative; this is especially true in the small type of gland.
4. The greatest value of propylthiouracil appears to be in the preparation of the bad risk types of toxic adenomata and of exophthalmic goiter for thyroidectomy. In the former group are the aged, those who have sustained severe cardiovascular damage from a prolonged disease condition, and those suffering from other complications, such as diabetes and liver damage. In the latter group are the very young and the aged, those with large friable, vascular glands and severe hyperthyroidism, and those who have other coexisting diseases.
5. In this study of 70 cases no toxic reactions were observed, and in only one case did the white blood cell count fall below 5,000.
6. The average dosage of propylthiouracil now being used by the writer is 50 mg. three times a day. The dosage is varied according to severity of the disease.

7. As soon as the basal metabolic rate approaches normal, the patient is continued on a smaller maintenance dose.
8. The time required to bring the basal metabolic rate to normal is variable, but the response is somewhat quicker than when thiouracil is used.
9. A white blood cell count is taken every three weeks, and the patient is warned of the same possible toxic reactions that may occur with thiouracil.
10. One case of agranulocytosis occurring from the use of propylthiouracil has been reported by Bartels. Consequently, all cases under treatment should be carefully observed.
11. The use of propylthiouracil is still restricted. The pharmaceutical houses making this drug, Lederle and Lilly, state that the available supply is still limited. It is hoped that this drug will soon become generally available and so replace thiouracil as a much safer means of treating hyperthyroidism.

REFERENCES

1. Astwood, E. B.: Clinical Data on the Use of Propylthiouracil. Presented at the annual meeting of the American Association for the Study of Goiter, June, 1946.
2. Astwood, E. B.: Propylthiouracil in Hyperthyroidism, Ann. Int. Med. *25*:773-892 (Nov.) 1946.
3. Astwood, E. B.: The Treatment of Hyperthyroidism with Thiourea and Thiouracil, J.A.M.A. *122*:78-81 (May 8) 1943.
4. Bartels, E. C.: Personal communication to the author received Feb. 7, 1947.
5. Hardy, S. M.: Personal communication to the author received Feb. 11, 1947.
6. Jackson, A. S.: Propylthiouracil in the Treatment of Toxic Goiter, Jackson Clin. Bull. *9*:12-15 (Jan.) 1947.
7. Jackson, A. S.: Thiouracil in the Treatment of Hyperthyroidism, Jackson Clin. Bull. *6*:146-159 (Sept.) 1944.
8. Jackson, A. S.: Thiouracil Will Not Replace Thyroidectomy, Surg., Gynec. & Obst. *83*:249-252 (Aug.) 1946.
9. Jackson, A. S.: The Use of Thiouracil in Hyperthyroidism, Am. J. Surg. *67*:467-478 (March) 1945.

MUSCULAR RELAXATION IN ABDOMINAL SURGERY WITH THE USE OF PENTOTHAL-OXYGEN AND CURARE

Report of Over 1,100 Cases

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IN the January, 1947, issue[21] of THE SOUTHERN SURGEON we published a preliminary report on the use of pentothal-oxygen-curare in obtaining muscular relaxation in abdominal surgery in 609 cases. Since the compiling of those cases we have continued this study and now are able to give you the reports of over 1,100 cases in which this form of anesthesia has been used. We feel this is a large enough series on which to base some very well founded conclusions. These conclusions are, we believe, of significance to you as surgeons for they were formulated by surgeons from the operator's viewpoint.

Since one of us[1] introduced pentothal-oxygen to the surgical armamentarium of the Georgia Baptist Hospital some 10 years ago it has been used more or less enthusiastically by the surgeons of Atlanta and the South. There have been, however, various limitations and objections to its use. Most of these are based on the large amount of drug required for adequate relaxation in abdominal surgery. Many surgeons and anesthetists, in order to overcome this, yet retain the attributes of pentothal-oxygen, have used various other agents as synergists with varying degrees of success. After the experiences of Griffith,[5] Cullen,[17] Hudon[6] and others, the Anesthetic Department of the Georgia Baptist Hospital tried using curare with pentothal-oxygen, and obtained such gratifying results that this form of anesthesia has now surpassed all others at the Georgia Baptist Hospital.

Curare is not an anesthetic agent, although mild anesthetic properties have been ascribed to it.[2] The main action of curare[9] is muscular relaxation by interrupting the efferent impulses at the myoneural junction, presumably by neutralizing the action of acetylcholine.

The first reference to curare in the literature[3] dates back to Sir Walter Raleigh's account of the discovery of the "large, rich and beautiful empire of Guiana" in 1595. He describes curare's use by

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the natives in war and hunting and expresses his desire to find an antidote to its poisonous effects.

We find that the first therapeutic use[3] of curare was probably by Demine, who treated 24 cases of tetanus with 8 recoveries about 1867. Since that time the drug has been variously used for chorea, hydrophobia, fits and tetanus—and by the end of the nineteenth century was recognized in Europe as a therapeutic agent in desperate cases.

After a great deal of experimental investigation in the decade preceding 1940, Bennett[4] first reported its clinical use in preventing injuries during convulsive seizures in shock therapy in psychiatry. In 1942 Griffith[5] reported its use in anesthesia mainly with cyclopropane and 2 years later Hudon[6] reported its use as an adjunct to pentothal sodium.

Curare is a mixture of the watery extracts of a number of plants mostly of the stychnos species. Its activity is due to crystalline d-tubocurarine chloride. It is offered for therapeutic use by E. R. Squibb & Sons as "Intocostrin,"[7] a purified and accurately assayed extract from the chondodendron tomentosum.

Recently E. R. Squibb & Sons have offered a purer product known as "d-tubocurarine." This is an aqueous solution of pure d-tubocurarine chloride. Our experience with this latter product is essentially the same as with "intocostrin" and since it has only been available a few months we have not had ample apportunity to observe it enough to draw definite conclusions; however, at this time we feel that the intestines "lay down" even more completely than with "intocostrin."

The action of d-tubocurarine chloride,[8] as previously mentioned, neutralizes the acetylcholine reaction at the myoneural junction and can be immediately reversed by physostigmine, which inhibits the choline esterase and restores the acetylcholine preponderance.

Curare affects the various muscles of the body in the following order[9]—first those enervated by the cranial nerves; second those of the trunk and extremities; third those of respiration; fourth and last, those of the diaphragm. It is interesting to note that we use tubocurarine to relax the throat so that laryngoscopic examination of the vocal cords can be made during or following thyroidectomy and even though the throat muscles are well relaxed the vocal cords are still active and not paralzed with this concentration (usually 40 to 60 mg.). There is no effect on the heart action[10] except as might result from apnea and from lowered blood pressure (the latter of which results from peripheral relaxation of the skeletal

muscles). The smooth[11] muscles of the vascular system are not affected, nor do the rate, rhythm, P-R, QRS, and QT interval, amplitude or configuration of the individual complexes of the electrocardiogram show any variation. Harris[12] reports that "no changes which at present would be considered abnormal were observed in the electroencephalogram where curare was administered." Griffith[13] states that "curare is rapidly broken down in the body and completely eliminated." The former[10] mostly by the liver and the latter by the kidneys. When curare alone is administered intravenously, it acts within 30 seconds, maintains its maximum effect for 5 to 10 minutes, and then gradually subsides so that the effect is entirely gone in 20 minutes. The rapidity of elimination from the body is undoubtedly the greatest safety factor in the use of curare.

This time element apparently is slightly lengthened in the premedicated anesthetized patient or in the patient receiving multiple or large doses of curare. Smith et al[18] in the January, 1947, issue of Anesthesiology give a detailed report of the experiences and scientific recordings on Dr. Smith as he was personally given 500 mg. d-tubocurarine in a period of 33 minutes without other medication. Dr. Smith dictated his sensations until such time as his throat muscles were paralyzed so he could not talk. He was given more d-tubocurarine in 100 mg. doses and his skeletal muscles were completely paralyzed when he had received about 250 mg., but he continued to communicate with his friends by prearranged signals asking for more tubocurarine. During this period he was given artificial respirations at the rate of 24 per minute. His memory and sensorium remained clear. He could plainly see objects held before him when his eyelids were opened. The last muscle to be paralyzed, strangely enough, was a portion of muscle over his left eye. Following administration of 500 mg. in 33 minutes he was given repeated injections of physostigmine and was soon up walking around none the worse from his experience. Electrocardiogram and electroencephologram showed no changes during the whole procedure. This is a most revealing report and should be of interest to all who are interested in curare.

Contraindications[9] to the use of curare are myasthenia gravis and the inability of the anesthetist to perform artificial respiration which can be easily accomplished with a clear airway and an inhalation bag of any anesthetic machine. It is also thought advisable to administer curare rather sparingly to patients suffering liver or kidney deficiency since these organs are instrumental in its detoxification and elimination. A very striking example of an over-dose of curare was reported by Robson[13] of Toronto in 1945. The patient

was 2 weeks old, weighed 8 pounds, and was being operated on for a complete diaphragmatic hernia. By some mistake she was given 1 c.c. (20 mg.) of intocostrin intravenously, which is some 15 times the recommended dosage for this patient. However, artificial respiration was maintained for more than 3 hours and the baby made a complete recovery.

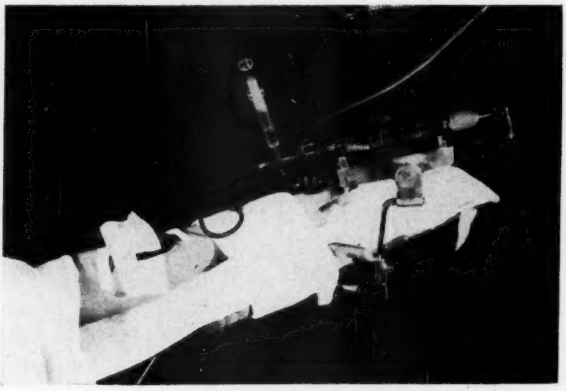

Fig. 1. Method of Administration

Two three-way stopcocks are attached to the syringe on a Rudder Pentothal holder, and saline, plasma or whole blood (as may be required) is attached to one side. The usual connecting tube leading to the intravenous needle is attached in the usual position. A 5 c.c. syringe is attached to the remaining opening. This 5 c.c. syringe is used to inject curare into the system and can be detached when not in actual use to prevent its falling or being hit and broken off. If intocostrin or d-tubocurarine is injected into pentothal, a yellowish white precipitate is formed which is precipitated pentothal acid and is soluble in an excess of pentothal or plasma.[14] Intocostrin and d-tubocurarine are organic salts of a weak base and a strong acid, thus is acid in reaction (pH 5.1.) and percipitates the basic sodium pentothal out of solution. No harm is done but it is not desirable and may tend to stop up one side of the stopcock. The initial dose of curare is 40 to 100 mg. which is given just after the skin incision is made. More curare is added as needed for desired relaxation, and more pentothal is given as needed to keep the patient lightly anesthetized. Knight[22] emphasizes that the shock is directly proportional to depth of anesthesia. Oxygen is given continuously.

We have compiled the pertinent facts of 1106 major operations (Table 1) in which pentothal-oxygen-curare anesthesia was used.

TABLE 1

Operation	Pentothal Grams			Curare Mg.			No. Cases
	Max.	Min.	Av.	Max.	Min.	Av.	
Exploratory	2.7	0.6	1.25	260	60	150.0	53
Gallbladder	2.8	0.7	1.24	240	60	148.0	136
Caesarian Section	1.7	0.7	1.29	100	60	80.0	14
Gynecologic	3.3	0.7	1.47	260	40	138.0	405
Intestinal & Stomach	3.2	0.7	1.82	300	40	136.5	49
Appendectomy	2.6	0.5	1.31	200	20	106.0	376
Herniorrhaphy	4.1	0.7	1.88	200	60	114.7	56
Kidney	2.3	1.1	1.58	140	60	91.6	12
Esophagoscopy			1.3			40.0	1
Laryngoscopy	1.6	1.0	1.2	100	60	90.0	4
	Average		1.43	Average		105.8	1106

For a comparison we also compiled statistics on a corresponding group of cases on which pentothal alone was used, and offer them for your consideration. These cases include our own private patients as well as those of other surgeons of Georgia Baptist Hospital Staff. This report does not include the many anesthetic agents other than pentothal used with curare whose records are in the archives of the Georgia Baptist Hospital. We would like to pause to say that these anesthetics were quite satisfactory and a definite help was given the anesthetist and surgeon in these cases by the addition of curare and, although no record of the amount of anesthetic agent used is available, it is the opinion of all the anesthetists that considerably less was needed.

There are several changes in the averages in this report from those in our preliminary report. In general they show that we are using more curare and less pentothal. This was anticipated, for, when we were feeling our way, we used less curare than at present and, since the major objection to pentothal is large dosage and long postoperative sleeping, both of these are being reduced.

The greatest reduction (Table 2) in the amount of pentothal required was observed in the series of exploratory laparotomies.

TABLE 2

Operation	Pentothal 02 Alone	Pentothal 02 With Curare	Less Pentothal Per Cent
Exploratory	2.12	1.25	41.0
Gallbladder	1.96	1.24	37.7
Caesarian Section	1.84	1.29	28.9
Gynecologic	1.90	1.47	22.6
Intestinal & Stomach	2.33	1.82	21.9
Appendectomy	1.44	1.31	9.9
Herniorrhaphy	1.81	1.88	3.8
		Average	26.3

This series included ruptured peptic ulcer, as well as operations where a diagnosis was in doubt and the recesses of the abdomen had to be explored, thus requiring great relaxation of the abdominal musculature. These patients were usually rather excited and had rather severe pain, since theirs were usually emergency operations. The average amount of pentothal required was reduced from 2.12 Gm. to 1.25 Gm., or 41 per cent, by the average addition of 150 mg. curare.

The next highest reduction was observed in the series of gallbladder operations where the pentothal average was reduced from 1.96 Gm. to 1.24, or 37.7 per cent, by the average addition of 148 mg. of curare.

Caesarian section showed the next largest reduction from 1.84 Gm. pentothal to 1.29 Gm., or 28.9 per cent less pentothal with the addition to 80 mg. curare. We inquired rather closely into this series and found that all the babies breathed immediately (except one case which had a ruptured uterus with a dead baby)—they were all classic Caesarean sections, none being done as the low cervical or the extraperitoneal method so that the time between the injection of the pentothal and curare and the extraction of the child was minimum. There is still some doubt in our minds as to the advisability of doing the other type Caesarean section in which the baby is not as quickly extracted, for it is certainly rational to believe that the baby might receive an overdose of either or both drugs and that difficulty in respiration would follow.

Under gynecologic operations were grouped all gradations of

pelvic work, from complete hysterectomies to perineal repairs and dilatation and curettement, so that the average reduction of pentothal is small because some of these operations needed little or no relaxation at all and curare was given mainly to broaden our experience with the drug and to prove that it was of relatively little use in operations not needing relaxation. However, the average amount of pentothal was reduced from 1.9 Gm. to 1.47 Gm., or 22.6 per cent.

TABLE 3

Relationship of Amount of Pentothal to Length of Operation

OPERATION	Operating Time Minutes	Amount of Pentothal Grams
Intestinal & Stomach	126	1.82
Hernia	79	1.88
Gynecology	76	1.47
Gallbladder	65	1.24
Exploratory	53	1.25
Appendectomy	42	1.31

All the stomach and intestinal surgery was grouped together—this included gastrotomy, gastric resections, vagotomies, gastroenterostomies, enterocolostomy, colon resections and colostomies. In the majority of these procedures profound relaxation is mandatory, yet the average was lowered some by the simple operations also included. The average amount of pentothal was reduced from 2.33 Gm. to 1.82 Gm., or 21.9 per cent, with the average addition of 136.5 mg. curare. These were by far the longest operations of the series, averaging 126 minutes, so it is expected that a large quantity of pentothal would still be necessary to maintain unconsciousness for this period of time. As much as 300 mg. of curare was used on a 47 year old male undergoing gastric resection. This is the largest dose of curare that was given in this series and we would like to point out that this patient had no untoward effects.

The average reduction of pentothal used for appendectomies dropped from 1.44 to 1.31, or 9 per cent. This low drop is due to a lessened need for muscular relaxation.

In hernial operations a surprising thing was noted in that the

cases using pentothal alone averaged 1.81, while those to whom the curare was also given required 1.88 Gm. pentothal, or an increase of 3.8 per cent. On reviewing these charts and questioning our anesthetists we believe this is not a true comparison for the people on whom curare was used were without exception all large males. Thus a greater amount of any type anesthesia would be required, whereas our figures on pentothal alone were consecutive cases, thus not all husky males.

TABLE 4

Relationship to Muscular Relaxation

Operation	Amount of Curare Mg.
Exploratory	150.0
Gallbladder	148.0
Gynecologic	138.0
Intestinal	136.5
Hernia	114.7
Appendectomy	106.0
Kidney	91.6
Caesarean	80.0

1 Mg. equals 1 unit.

The average reduction of pentothal in the 1,106 cases here reported varied from 41 per cent to minus 3 per cent, or an average of 26.3 per cent, which is a goodly amount of the drug and was undoubtedly the big factor in reducing the length of postoperative sleeping. In fact the vast majority of these patients were awake by the time the surgeon arrived in the room following operation.

As seen in Table 3 there is noted a general relationship to the operative time and the amount of pentothal required. The relationship is not arithematic but is by geometric progression because of the cumulative effect of the drug, as well as the tolerance built up. There is little relationship between amount of curare and time but, as noted in Table 4, there is a definite relationship between amount of relaxation required for different operative procedures and the amount of curare required. The more relaxation the more curare required, whereas the more time the more pentothal—of

course there is some relationship of curare to time because of its early breakdown and elimination, yet the main relationship between the two is relaxation.

Baird[20] has suggested the use of a fixed relation mixture of pentothal and d-tubocurarine and has used 5 mg. d-tubocurarine and 23.75 mg. pentothal in solution, which is quite stable in over 200[19] cases. We cannot agree with this for on reviewing these 1,106 cases we diligently tried, before hearing of his work, to derive some

TABLE 5

Ratio Pentothal to Curare

OPERATION	Actual Pento/ Curare	Greatest Ratio Pento/ Curare	Least Actual Pento/ Curare	Ratio Pento/ Curare	Average
Exploratory	1.2:265	1:221	3.2:280	1:87.5	1:120
Gallbladder	0.7:200	1:317	2.8:160	1:57.0	1:119
Caesarean Section	0.7:100	1:143	1.2:60	1:50.0	1:67
Gynecologic	1.0:180	1:180	2.3:40	1:17.4	1:94
Intestinal & Stomach	1.6:220	1:137	1.8:40	1:22.2	1:75
Appendectomy	1.5:180	1:120	0.9:20	1:22.1	1:81

fixed relationship of the amounts of pentothal and curare required as far as type operation, time of operation, type individual, but we were unable to derive any formula which would hold anywhere near true for this relationship. You will note that none of our ratios (Table 5) approaches Baird's[20] ratio which is 1 Gm. pentothal to 210.5 mg. tubocurarine. We believe that if a fixed relationship existed between the drugs we would have been able to derive it from these 1,106 cases, at least for different type procedures but there is too much variance even in these for any fixed mixture. There is too much individual difference in tolerance to the drugs.

In order to determine the effect of pentothal-oxygen-curare anesthesia as we use it at Georgia Baptist Hospital we compiled and averaged any rise or drop of the systolic or diastolic pressure in the first 15 minutes following the administration of the curare as shown in Table 6. The greatest change was 40 mm. mercury drop in systolic pressure in a patient who came to the operating room quite nervous and upset with a pressure of 180 mm. Hg. This drop came on immediately after she was put to sleep and we feel that this

TABLE 6

Blood Pressure Changes Within 15 Minutes After Giving Curare

	Maximum Fall MM. HG.	Maximum Rise MM. HG.	Average MM. HG.
Systolic Pressure	40	30	—1.45
Diastolic Pressure	20	25	—0.209

would have happened under any anesthesia which would quiet her. The greatest rise was 30 mm. Hg. An average of all rise and fall of the systolic pressure showed a drop of 1.45 mm. Hg. We found several patients who had a fall of 20 mm. Hg. in diastolic pressure. The greatest rise was 25 mm. Hg.—the overall average showed a drop of the diastolic pressure of 0.209 mm. Hg. These results of rise and fall in blood pressure are in accord with the observations of Gross, Cullen[15] and Smith.[16]

There was no instance of local phlebitis following curare injection nor any other local effects on the vein.

In spite of all the warnings in every paper we have reviewed concerning respiratory paralysis, there was not a single instance in which artificial respiration was indicated in this series. There was never any need for the injection of prostigmin; however, in a few cases when our experience with curare was still meager we gave some prostigmin as the patients were leaving the operating table just to assure ourselves that nothing would happen to the patient after returning to the room, but at no time was it really needed.

In administering curare to a patient who is straining and pushing intestines out of the incision, it is an amazing sight to watch those intestines, which were a moment before trying every conceivable trick to escape from the abdominal cavity, now turn and crawl back into the incision. This is thought[15] to be due not to an increased tonicity or activity in the gut but to the improved abdominal muscle relaxation.

It is interesting to note that several cases of hiccoughs were successfully treated with curare alone after other usual methods had failed. It has also failed to cure hiccoughs in several instances.

Conclusions

1. We have reported the use of pentothal-oxygen-curare anesthesia in 1,106 cases which quite satisfactorily afforded us adequate muscular relaxation under very light anesthesia.

2. We have also reviewed all the available literature about curare.
3. The addition of curare diminished the amount of pentothal used by 26.3 per cent, thus allowing patients to undergo even the largest operations without the attendant dangers of deep anesthesia necessary without curare.
4. We prefer the synergistic effects of pentothal-oxygen-curare in abdominal surgery over spinal, cyclo, nitrous, ether or local, either alone or in combination with other agents, including curare, for the induction is rapid, the effects pleasant for the patient—postoperative complications are markedly lowered, the danger of explosion minimized—post spinal headaches, etc., eliminated. Curare supplements pentothal's lack of relaxation while pentothal supplements curare's lack of anesthetic properties, thus forming a very acceptable combination, one which has very few objectionable factors.
5. We do not believe that a fixed relation mixture of pentothal-curare should be used because of variations of requirements of different operative procedures in different individuals.
6. Curare should not be used in cases of myasthenia gravis, or when the anesthetist cannot give artificial respiration. The inexperienced user of curare should proceed with utmost caution.
7. We believe that curare is a most valuable adjunct to anesthesia when muscular relaxation is necessary with pentothal or any other anesthetic agent.

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BIBLIOGRAPHY

1. Davison, T. C., and Rudder, F. F.: The Use of Pentothal Sodium-Oxgven Anesthesia as a Total Anesthetic Agent in Major Surgical Procedures. J.M.A. Georgia *29*:475 (Oct.) 1940.
2. Adams, R. C.: Curare as an Aid to Relaxation in Anesthesia, S. Clin. North America, *25*:735-739 (Aug.) 1945.
3. West, R.: The Pharmacology and Therapeutics of Curare and Its Constituents, Proc. Roy. Soc. Med. *28*:565 (Mar.) 1935.
4. Bennett, A. E.: Curare: A Preventive of Complications in Convulsive Shock Therapy, Am. J. Psychiat. *97*:1040 (Mar.) 1941.
5. Griffith, H. R., and Johnson, G. E.: The Use of Curare in General Anesthesia, Anesthesiology, *3*:418-420 (July) 1942.
6. Hudon, F.: The Use of Curare as an Adjunct in General Anesthesia, Laval Méd. *9*:242 (Apr.) 1944.

7. E. R. Squibb & Sons: Booklet: Curare Intocostrin, p. 5, 1945.

8. Fegler, J., and Kowarzyk, K.: Reciprocal Antagonism Between Physostigmine and Curare, Compt. rend. Soc. de biol. *127:*1149 (#12) 1938.

9. Cole, F.: The Use of Curare in Anesthesia: A Review of 100 Cases, Anesthesiology *6:*48 (Jan.) 1945.

10. Cullen, S. C.: Clinical and Laboratory Observation on the Use of Curare on Inhalation Anesthesia, Anesthesiology *5:*166 (Mar.) 1944.

11. Ruskin, A.: Ewalt, J., and Decherd, G.: The Electrocardiogram of Curarized Human Patients, Dis. Nerv. System *4:*335 (Nov.) 1943.

12. Harris, M. M.; Pacella, B. L., and Horowitz, W. A.: A Study of the Use of Curare in Metragol Convulsant Therapy with Some Electroencephelographic Observations, Psychiatric Quart. *15:*537 (July) 1941.

13. Griffith, H. R.: Curare as an Aid to the Anesthetist, Lancet *2:*74 (July 21) 1945.

14. Personal communication to authors from L. H. Wright, M.D., Chief, Dept. Anesthesia, E. R. Squibb & Sons.

15. Gross, E. G., and Cullen, S. C.: The Action of Curare on the Smooth Muscle of the Intestine and on the Blood Pressure, Anesthesiology *6:*231 (May) 1945.

16. Smith, S. M.: Curare as an Adjunct During Inhalation Anesthesia: Report of 50 Cases, Rocky Mountain M. J. *41:*313 (May) 1944.

17. Cullen, S. C.: The Use of Curare for Improvement of Abdominal Muscle Relaxation During Inhalation Anesthesia, Surgery *14:*261 (Aug.) 1943.

18. Scott, M. S., et al: Lack of Cerebral Effects of D-tubocurarine, Anesthesiology (Jan.) 1947.

19. Baird, J.: Personal communication to the authors.

20. Baird, J.: Pentothal Curare Mixture, Anesthesiology (Jan.) 1947.

21. Davison, T. C., and Letton, A. H.: Muscular Relaxation in Abdominal Surgery with the Use of Pentothal-Oxygen-Curare: Report of over 600 Cases, South. Surgeon *13:*15 (Jan.) 1947.

22. Knight, R. T.: The Use of Curare in Anesthesia, Minnesota Med. *27:*667 (Aug.) 1944.

THE USE OF TENDON GRAFTS IN INJURIES OF THE FLEXOR TENDONS OF THE HAND

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FREE gliding movement of the flexor tendons is essential for the function of the hand. To restore it once it is lost as a result of injury or infection is a difficult and incompletely solved problem.

Because restoration is so difficult, a word concerning the "ounce of prevention" is in order. The flexor mechanism of fingers and thumb consists essentially of a powerful motor—the flexor muscles of forearm and palm, whose action is exerted upon strong, perfectly smooth taut cords—the flexor tendons, which are held in firm, perfectly fitting sleeves—the fibrous tendon sheaths, and are attached in turn to a series of hinged blocks of bone—the phalanges.

The motor must be strong, the taut cords must be intact; they must glide with a minimum of friction and remain in place within their retaining sleeves as they draw the phalanges into a curved or concave position; the hinges must not creak.

Our problem today concerns particularly the cords and the retaining sleeves. The motor, the hinges, the cords that draw the blocks back again into a straight line—the extensor group—we shall ignore for the moment.

Even a smooth and limited swelling of the cord or tendon can interfere with its free movement. The so-called trigger finger is a familiar example of such a complication. If the surface of the cord or the lining of the sleeve is roughened movement is impaired, and if they become adherent to each other free movement is impossible. If the sleeve is slit open along its superficial aspect tension upon the cord lifts it out of the sleeve and the mechanical advantage of the pull upon the blocks of bone is lost.

How can such difficulties be avoided? First, by making incisions that avoid the superficial aspect of the retaining sleeve and so prevent the tendon from being lifted out of its sheath. Secondly, by making certain that in any operative procedure bleeding is completely arrested and that no oozing persists to cause fibrous tissue formation between tendon and sheath. Thirdly, by using the finest and least irritating suture material in repair. Fourthly, by making as certain as possible that no infection is present at the time of repair

From the Department of Surgery, Northwestern University Medical School.

Read before the fifteenth annual Postgraduate Surgical Assembly of The Southeastern Surgical Congress, Louisville, Kentucky, March 11, 1947.

or develops afterward. No one factor is more certain to defeat the surgeon because of the destruction of normal tissue and the forma-

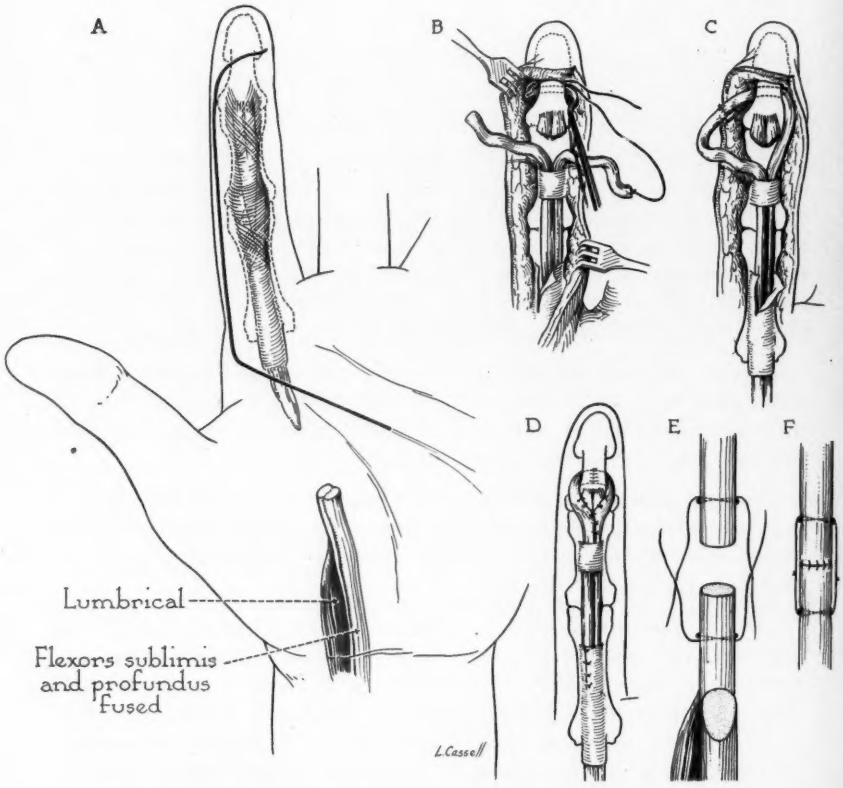

Fig. 1. Technic of substituting a free tendon graft for hopelessly injured flexor tendons. A, Incision. B, After fibrosed flexor tendons have been excised free grafts are drawn through the carefully preserved tendon sheath and a guide suture is carried around the distal phalanx through a shallow tunnel made with a sharpened aneurysm needle. C, The free ends of the two tendons are smoothly united; by tension on the tendon first drawn through the tunnel, the two grafts are drawn taut, and the line of suture comes to lie in the midline on the dorsum of the distal phalanx. D, Fine silk sutures between tendon graft and stump of profundus help to make attachment of graft to distal phalanx secure. E, F, Suture of proximal end of graft to proximal segment of flexor profundus. Incision in finger is closed before suture of graft to profundus is carried out.

(From Quart. Bull., Northwestern Univ. M. School *19*:265, 1945)

tion of scar tissue that result from infection—scar tissue that holds in a vise structures which should move and glide as easily as a well oiled piston moves within a perfectly fitting cylinder.

If function has been lost as a result of injury or infection successful repair is rendered difficult by the retraction of the proximal segment of the tendon and by the contraction of the inactive muscle, by the difficulty of securing sound healing of poorly vascularized tendon ends if the division has taken place within the tendon sheath, and by the often extensive injury of the smooth gliding surface of the tendon and of the synovial lining of its sheath.

Fig. 2. Substitution of tendon grafts from foot for divided and widely separated flexor tendons of middle finger. Left, before operation; right, 3 months after operation.

(From Quart. Bull., Northwestern Univ. M. School *19*:265, 1945)

The most satisfactory method that has been found of securing return of function in such cases has been the removal of the scarred remains of tendon and adherent tendon sheath and substitution of normal uninjured tendon from some other part. In carrying out such a procedure several important principles should be kept in mind. Incisions should avoid flexion creases and if possible should not lie over lines of tendon suture. Scar tissue about the site of injury is removed as completely as possible, but all available normal sheath tissue is preserved so that enough of the retaining sleeve of tendon sheath remains to hold the new tendon in place. If the sheath tissue is entirely destroyed new annular ligaments are provided with slips of normal tendon from the foot. The new tendon should be removed from its original site with its covering of thin areolar tissue, not drawn through small incisions or removed with a fascial stripper. There is no better way of insuring free gliding movement of the tendon graft than by leaving it surrounded with a thin layer of areolar tissue such as covers the long extensor tendons on the dorsum of the foot.

We are very reluctant to consider the use of any foreign material such as amniotic membrane, cellophane or tantalum foil to prevent

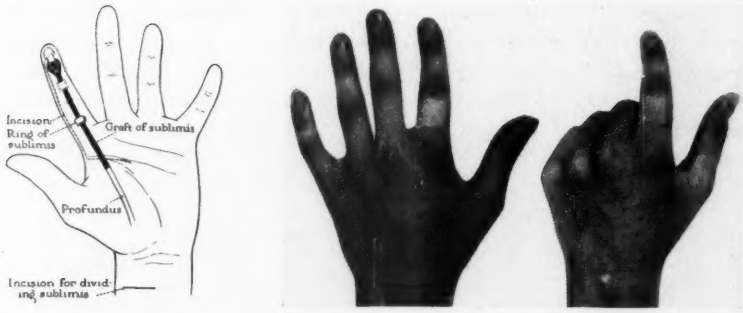

Fig. 3. Use of graft of sublimis to fill the defect between the distal phalanx and the retracted proximal segment of the flexor profundus of the index finger. A slip of extensor tendon from the foot was used to construct a new annular ligament about the proximal phalanx. Above, diagram of operative procedure, and the condition before operation.

Fig. 4. Operative result: left, 3 months after operation; right, 6 months after.

adhesions between tendons and surrounding tissues. In the few cases in which we have observed the effect of such materials the result has been quite the opposite from that which was hoped for.

A final word should be added concerning care during the postoperative period. The immobilizing splint applied immediately after operation supports the hand in flexion at wrist and metacarpophalangeal joints so as to minimize tension on the graft. Such support is maintained for a period of from 3 to 4 weeks to permit sound healing of graft to distal phalanx and of graft to proximal tendon. During the latter part of this period gentle active movement of the fingers is begun at each change of dressing, but without changing the position at wrist or knuckles. At the end of four weeks gentle active movement of the entire hand is begun and the splint is partially straightened. All splinting is discontinued in another 7 or 10 days, approximately 5 weeks after operation.

BILIARY PERITONITIS

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The many causes and methods of prevention applicable to peritonitis resulting from infection are well known. One form, however, biliary peritonitis, has not been accorded the consideration deserved. Many of us have thought that following daily elective operations involving the abdominal cavity, a resulting acute peritonitis is rare and usually preventable, so much so that its occurrence arouses our surgical conscience to self-castigation.

Pflaum[1] has made an interesting study on the etiology of peritonitis, based on autopsy findings, which is a fund of information to the surgeon. He found that the greatest number of deaths from peritoneal infection were secondary to operative procedures in clean cases.

A knowledge of the clinical pattern of biliary peritonitis is essential to the proper care of diseases involving the biliary tract, since in many instances an early recognition of the condition with prompt intervention reduces both mortality and morbidity.

James[2] has summarized the more common modes of bile entry into the peritoneal cavity:

a. Extravasation from the gallbladder, either from an obvious perforation at the site of necrosis of the wall, or in instances in which no perforation can be found . . . non-perforative peritonitis.

b. Effusion from the bile ducts themselves attributed to local digestion of the wall by reflux of pancreatic juice, local ulceration or rupture of the wall.

c. Trauma, from crushing injury of the upper abdomen or following cholecystectomy.

d. Rupture from congenital abnormalities of the bile ducts.

Perforation of the gallbladder has been reported by Eliason and McLaughlin[3] as a complication in from 1 to 3 per cent of all cases of disease involving the biliary tract. The incidence of perforation of the gallbladder or ducts with peritonitis in cholecystic disease has shown very wide variations from 10 to 7 per cent; we feel that

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From the Department of Surgery, University of Louisville.

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the former is rather high. The reports on incidence are varied depending on the difference of clinical data as compared to operative findings.

Fear of the consequences of bile leakage into the peritoneal cavity has fostered the general belief that it is necessary to institute drainage in all operations upon the biliary tract and that omission of drainage is an admission of poor surgical judgment. Most surgeons, we believe, do not drain more than 60 per cent of their cholecystectomies and to a small number, drainage has become a surgical practice to be abhorred. It might seem that a middle course is justified, relying on definite indications and not indiscriminate usage.

We are not convinced that so-called "ideal cholecystectomy" is a safe routine procedure in most cases, after having to re-open the abdomen on several occasions to evacuate a local collection of bile and having seen death follow from biliary peritonitis resulting from failure to drain. The late Sir Berkeley Moynihan[4] once said, "I never close the abdomen without a drain, though in the days of my adventurous youth, I often did so," but it must be remembered that this gentleman also ventured to quote Samuel Butler's trite remark "consistency is a vice which degrades human nature and levels man with the brute."

The presence of bile in the peritoneal cavity follows in many instances from aberrant bile ducts in the gallbladder fossa after cholecystectomy or improper ligation of the cystic duct stump which by reason of its mucous lining possesses none of the self-sealing characteristics of endothelial-lined vessels. We have not found accurate suturing of the gallbladder fossa as a good preventative of bile leakage from the denuded liver surface but in many instances touching the exuding areas with the coagulating current has been efficacious.

A virulent type of biliary peritonitis may follow operations on the acutely-infected gallbladder or the loosening of a poorly-anchored tie on the cystic duct allowing the escape of infected bile into the general peritoneal cavity. Effusion of bile into the peritoneal cavity without visible perforation of the biliary tract is not too infrequent and may present a bizarre group of symptoms.

In 1910, Clairmont and von Haberer[5] reported biliary peritonitis without perforation as a definite entity which has been followed by extensive investigation. Several clinical reports of bile peritonitis without evidence of perforation of the gallbladder have been recorded and the names "sweating gallbladder" or "sieve gallblad-

der" have been used to designate the condition found at operation, i.e. filtration of bile through the gallbladder wall into the general peritoneal cavity. The phenomenon has been described as "biliary dew." Many ideas have been advanced to explain this interesting condition of "biliary dew," but none are found applicable to all cases. Most theories attempt to explain the accumulation of bile in the absence of visible perforation on a pathologic alteration in the gallbladder wall rendering it pervious to bile passage. It may be possible in cystic duct obstruction that minute focal areas of necrosis occur due to infection and circulatory changes. It seems reasonable that a stone impacted in the ampulla of the common duct might force pancreatic secretions into the gallbladder where activation by the bile could produce digestive changes in the wall resulting in transudation of bile into the free peritoneal cavity. From a purely physiologic basis the latter is open to argument because of the greater bile pressure in the common duct than that of the pancreatic juice which is not too conclusive as it has been shown that after the ingestion of food the pressure in the pancreatic ducts may be greater than the common bile duct pressure.

CASE 1. A well-nourished white soldier, aged 38, was admitted to the hospital from the field complaining of abdominal pain and distention. The pain had been rather vague for several days but on admission was intense and accompanied by vomiting. The distention had existed for 2 weeks, necessitating the gradual releasing of his belt. A chill had occurred 24 hours previous to hospital entry, followed by fever.

He appeared moderately ill, with temperature of 102°, pulse rate 104 and respirations 22. The abdomen was more than moderately distended but not tense; there was slight general rigidity with tenderness. The white blood count was 24,000, with 92 per cent polys. The abdominal distention was found to be due to fluid which was easily demonstrated by a fluid thrill. It was deemed advisable to perform a diagnostic aspiration from which pure bile was obtained.

At operation, on incising the peritoneum a large amount of bile poured forth; about 4,000 c.c. was evacuated from the peritoneal cavity. The intestines were highly injected and mild degrees of agglutination were demonstrated in keeping with acute biliary peritonitis. The gallbladder was not tense nor edematous but beads of bile stood out over the surface which slowly reformed after sponging. A small stone was palpated in the common duct which was removed by choledochotomy. A catheter drain was inserted in the choledochus and a second drain to the foramen of Winslow. There ensued a rather profuse bile drainage from the catheter for 10 days postoperatively.

Three weeks following operation, no re-accumulation of intraperitoneal bile was detected.

When administered parenterally the toxicity of bile and its salts has been long known. Whole bile may produce a severe systemic

toxic reaction when injected intravenously, intraperitoneally or subcutaneously.

In bile peritonitis, many investigators have shown that there is an enormous exudation of fluid into the peritoneal cavity. It is bile stained and not a transudate but clots and simulates blood plasma. Harkins, Harmon and Hudson[6] have estimated that the quantity of exudate is near one third the blood volume and 60 per cent of plasma volume resulting in a definite hemoconcentration. Fatalities may be precipitated by this factor plus a shock syndrome rather than a later infection. The accumulation of sterile bile in the peritoneal cavity may be far from innocuous; the surgeon can rarely tell for certain whether bile is sterile or not, and the accumulation of a large amount may lead to cholaemia and death attributable to toxicity of the bile salts.

The toxic effects of sterile fresh bile are greater than those produced by bile from obstructed ducts, because of the greater concentration of bile salts.

The peritoneal reaction to insult by sterile bile is of course one of the chemical irritation with an early resultant mild peritonitis followed later by cholaemia, but the peritoneal reaction to infected bile results in an early toxic violent type of peritonitis with inhibitory ileus. The clinical picture in acute biliary peritonitis from bacteria-laden bile may be ushered in with dramatic suddenness following perforation of the gallbladder or ducts comparable to other visceral perforations.

The factors contributing to shock in these catastrophies are probably the same as observed in burns and trauma, these factors being outflow of plasma from the circulating blood with increased hemoglobin concentration accompanied by diminished blood volume and lowered blood pressure. The onset is usually with sudden or rapidly-increasing epigastric pain which may have been preceded by colic. Tenderness and muscle spasm are widespread but there is usually an absence of the extreme board-like rigidity encountered in perforated peptic ulcer or acute pancreatitis. The presence of shifting dullness is often elicited. Confusion may cloud the picture by the gravitation of bile along the right colic gutter mimicking a perforated peptic ulcer or acute appendicitis. Mild distention is the rule. Jaundice is not common and is late in onset and mild in character attributable to a sudden flood of infected bile with a short time elapsing before general peritoneal infection ensues.

Ransohoff[7] has reported a most valuable sign when present, that of a localized jaundice around the umbilicus when bile is free in

the peritoneal cavity. Kehrs' sign, i.e. right shoulder tip pain, if often noted through irritation of the sensory branches of the phrenic nerve. It is well to remember that the accumulation of infected bile remains the third most important cause of subdiaphragmatic abscess and subphrenic infections.

CASE 2. A white woman, aged 49, was hospitalized complaining of severe epigastric pain which radiated over the right upper quadrant and mid-abdomen accompanied by chills and fever ranging from 99 to 103 degrees. The symptoms had persisted for 72 hours, with occasional vomiting. Her physician who had examined her on the day of admission disclosed he had treated her over a two year period for mild bouts of dyspepsia and on several occasions a mild jaundice had been present with clay colored stools. On admission the abdomen was moderately distended with general muscle spasm; extreme tenderness was present over the upper right quadrant. Blood pressure 95 mm. systolic and 70 mm. diastolic with white count of 19,000. At operation a widespread peritonitis was found with 2000 c.c. of bile free in the peritoneal cavity which was evacuated. The gallbladder was found to have a gangrenous perforated area near Hartmann's pouch with one large stone free in Morison's pouch. Because of the low situation of the perforation it was deemed advisable to perform cholecystectomy and institute drainage. The patient remained in a precarious condition for 10 days but recovered.

Of the organisms isolated in biliary peritonitis one finds B. coli predominant followed by streptococci and infrequently one of the Welchii group. It is an interesting observation that B. coli is capable of diffusing more rapidly through the peritoneal cavity than other organisms, while streptococci persist longest.

Should one be in doubt as to the diagnosis in an abdomen suspected of biliary peritonitis, aspiration may be resorted to but peritoneoscopy has appealed to us as being more safe and informative, especially in conjunction with radiologic evidence.

When a diagnosis is made, or reasonable evidence is at hand, of biliary peritonitis, an operation should be recommended and drainage instituted provided prostration and shock are not pronounced. Drainage is of immediate necessity both in a diffuse biliary peritonitis or any localized encysted collection; conservatism in either only invites mortality and increased morbidity. The time between perforation of a gallbladder or ducts and operation is of paramount concern: about 90 per cent recover when operated upon within the first 12 hours, 60 per cent in 24 hours and 40 per cent in 36 hours.

Whether one is dealing with rupture of the gallbladder or ducts, either traumatic or pathologic, direct drainage of the gallbladder and ducts, plus peritoneal drainage, are of primary importance except in the occasional case where more extensive surgery may be indicated, such as cholecystectomy, since the elimination of the

source of contamination is necessary before the peritoneum can care for the already present infection. Sulfa and penicillin therapy, with decompression and restoration of fluid and chemical balance, are used routinely.

Biliary peritonitis is always a serious condition as is choleperitoneum and the resultant mortality is near 50 per cent. We believe more importance should be attached to small collections of bile and immediate evacuation instituted. The potential possibilities of bile as a source of suppurative peritonitis should be emphasized the same as one views the leakage of gastroduodenal content from a perforated peptic ulcer.

BIBLIOGRAPHY

1. Pflaum, C. C.: Postmortem Analysis . . . Etiology of Peritonitis in 741 Cases, J. Missouri M. A. *30*:72, 1933.
2. James, K. L.: Bile Peritonitis of Unusual Causation, Lancet *2*:311, 1938.
3. Eliason, E. L., and McLaughlin, C. W.: Perforation of Gall Bladder, Ann. Surg. *99*:914, 1934.
4. Moynihan, Sir B.: Abdominal Operations, W. B. Saunders Co., p. 324, 1926.
5. Clairmont and von Haberer: Galliege peritonitis ohne perforation der gallenwege, mitt a.d. grenzgeb. d. Med u Chir *23*:545, 1910.
6. Harkins, H. H.; Harmon, P. H., and Hudson, J. E.: Peritonitis Due to Bile and Liver Autolysis, J.A.M.A. *107*:948, 1936.
7. Ransohoff, J.: Rupture of the Common Duct with an Unusual Sign, Southern Surgical and Gynec. Trans., p. 53, 1905.

FRACTURES OF THE HIP

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This presentation is based upon analysis of 50 consecutive cases of fracture of the upper end of the femur and 6 concurrent cases of dislocation of the hip treated by the author in his private practice during a recent period of two and a half years.

Fractures through the neck and trochanters of the femur are characteristically fractures of old age. This series included one infant of 10 months, one patient in the fourth decade of life, one in the fifth decade, 9 in the sixth, 14 in the seventh, 15 in the eighth, 6 in the ninth, and 3 in the tenth decade of life. Thus more than half of these patients were in their sixties or seventies. Excluding the infant, the average age was 69.

The sex distribution in hip fractures is predominantly female. In this group there were 37 females and 13 males. Again excluding the infant, the ratio is a little more than 3 to 1.

The trauma precipitating fractures of the upper end of the femur is usually slight. In 43 of these cases the history was of a fall only to the floor or pavement. Only 7 patients, roughly 1 out of 7, had fallen from greater heights or been injured in automobile accidents, and all of these patients were males.

The author is thoroughly convinced of the importance of early definitive treatment for all fractures. Forty-five cases, nine tenths of this series, were fresh fractures; of these, 22 were reduced and immobilized within 24 hours, 9 during the second day, 10 during the third day, and the remaining 4 before the end of one week.

The anatomic location of hip fractures has an important bearing on both their treatment and their prognosis. Following Whitman's classification, there were in this series 17 subcapital fractures, 12 of them fresh fractures and 5 of them cases of non-union more than a year old, 2 transcervical, 4 basal, 24 intertrochanteric, and 3 subtrochanteric fractures. In this classification subcapital fractures are entirely intracapsular and transcervical fractures are partially intracapsular. Of the fresh fractures in this series, more than one fourth were subcapital and more than one half were intertrochanteric. Analysis and discussion may profitably follow these anatomic groups.

Of the 17 patients treated for subcapital fracture of the neck of the femur, 14 were females and 3 were males, a ratio of almost

5 to 1. The average age was 70 years, essentially the same as for the entire group. Only 2, both males, had suffered more severe trauma than a fall to the ground.

Of the 12 recent subcapital fractures, 2 had definite fracture lines shown by x-ray, without appreciable displacement. Both were immobilized in long single hip spicas with the extremity in moderate abduction and internal rotation for periods of 6 weeks. Both walked within 3 months and both, naturally, had excellent results.

Four had closed reductions followed by immobilization in single long hip spicas in full abduction and internal rotation for 3 months. Three left the hospital within 3 days and the other one went home after one month. All attained bony union in good position, and all walked within 4 months. Two are classified as excellent results. One, aged 90, was senile, but stood and walked as well as before the accident. One attained a good functional result in spite of partial aseptic necrosis of the head.

Six recent subcapital fractures, half of the series, were subjected to closed reduction and so-called "blind nailing," meaning surgical exposure of the outer surface of the shaft only and nailing across the reduced fracture under x-ray control. The cannulated three-flanged nail, the Johansson modification of the Smith-Petersen nail, was used in every case. Two of the 6 had no postoperative immobilization other than elastic bandage spicas to support flabby tissues and eliminate dead spaces for 10 days. Both were confined to bed and bedside chairs for 2 months, both walked unassisted in 3 months, and both had excellent end-results. Two wore short single plaster spicas for approximately 2 months, one for additional security, the other for transfer home after 10 days. The latter walked in 3 months and had an excellent result. The other walked after 4 months, and had a fair result in spite of partial death of the head. Two cases had long single plaster spicas applied postoperatively, one for immediate transfer to a distant point, the other for transfer home after 19 days. The former is reported to have attained a good end-result. The latter fracture slipped 8 months later, after resumption of walking; it was remanipulated and renailed, and finally, 2 years after the original fracture, subjected to a Whitman reconstruction. This patient is still alive, free from pain, but does not walk, due to senility and long confinement.

Thus, in 12 recent subcapital fractures, 6 treated with internal fixation and 6 without, there were 11 bony unions, 2 with partial death of the head, and one non-union. In general, those immobilized in plaster only did better than those in which internal fixation was used. There were no deaths.

There were 2 transcervical fractures in this series. One, diagnosed by x-ray only, with no displacement, seen 4 weeks after a fall, was treated by bed rest only, and had an excellent result. The other, a man of 88, with a football-sized inguinal hernia, was reduced and nailed the day of his injury. No external fixation was

Fig. 1. Typical subcapital fracture, head displaced downward and backward.

used; he was out of bed in a week, went home in 10 days, walked in 2 months, and enjoyed an excellent result.

Of the 5 fractures, all more than a year old, all subcapital, which came to me with non-union, one had been immobilized in plaster only, 3 had had Smith-Petersen nails, and one had been fixed with a Lorenzo screw. In one case the nail had been removed and the head had been absorbed almost to the point of spontaneous formation of a Whitman reconstruction; the patient was elderly and frail, the functional result was fair, so no treatment was recom-

mended. One case presented a fibrous union in varus deformity, from which the nail had already been removed. A high subtrochanteric osteotomy was performed and a Blount blade-plate was introduced. Postoperative infection intervened, and the hardware

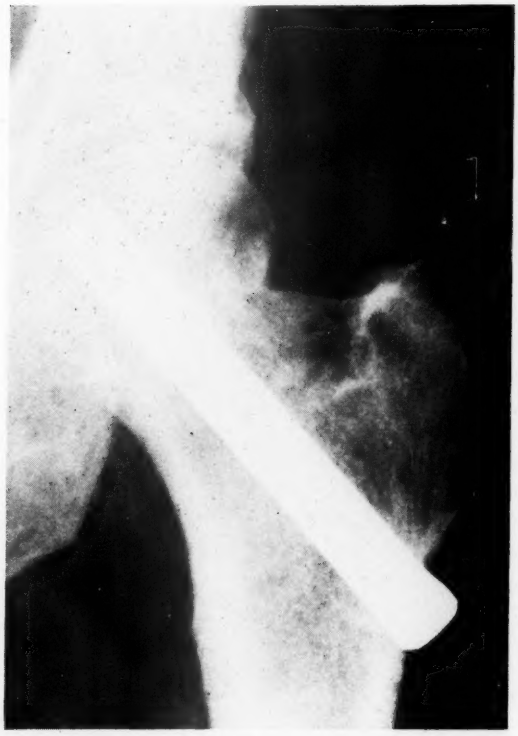

Fig. 2. Subcapital fracture subjected to "blind nailing"; valgus reduction, nail well placed and driven to proper depth, fracture impacted; early union, excellent function.

was eventually removed. The functional end-result is fair. Three patients were subjected to the classic Whitman reconstruction operation, modified only by the addition of a vitallium screw to supplement the suture fixation of the transplanted trochanter. All had short single hip spicas for 10 days postoperatively. One of these patients was mishandled immediately after her surgery, breaking the cast and dislocating the neck from the acetabulum, so that remanipulation was required. All walked within 6 weeks, all are relatively free from pain, but all have positive Trendelenburg signs.

SUMMARY

The cardinal signs of subcapital and transcervical fracture are pain, muscle spasm, external rotation, adduction, and shortening, the last less than in pertrochanteric fractures. X-ray examination is essential on suspicion of hip fracture, for the diagnosis of un-

Fig. 3. Same, lateral view.

displaced and impacted fractures and for the differential diagnosis of others. Definitive treatment should be applied as soon as possible, not merely as soon as convenient; the pain and shock progress in the untreated patient, adequate nursing is impossible, and pressure sores develop during any delay. Treatment consists of reduction and immobilization. Adequate reduction is essential to success, preferably an over-reduction, or "valgus" reduction, in which the head is placed above and anterior to the fractured extremity of the neck. The Leadbetter maneuver of traction in flexion, abduction,

internal rotation, and extension succeeds better and oftener than the classic Whitman method. The author frequently throws the flexed knee over his shoulder to add force to the first phase of this procedure. X-rays in two planes are absolutely necessary to check the reduction before any form of immobilization is begun. A pelvic rest is essential only if a plaster spica is to be applied. The choice between internal and external fixation of subcapital and transcervical fractures requires clinical judgment. "Blind" nailing is not a major operation, and it is not a long one when each of its steps proceeds smoothly and without repetition, but it is inevitably harder on the patient than the application of a plaster cast. Nails and screws do not reduce fractures, they do not of themselves promote union, and they immobilize the fragments only indifferently well. They can penetrate the spongy head fragment not more than an inch, where they are subjected to leverage from the entire length of the extremity. Furthermore, the absorption of the bone ends, a primary physiologic step in the union of any fracture, is more pronounced in the neck of the femur than elsewhere. Albee observed truly that, except for the autogenous bone graft, any medium which maintains both fragments of a fractured femoral neck in a fixed relationship defeats the progress of union. Nails, in successful cases, either penetrate farther into the head or back out of the shaft as union progresses. Screws with threads that are fixed, or become fixed, in both fragments are particularly unphysiologic.

Plaster hip spicas, at least single spicas, do not cause patients to die of either decubitus ulcers or hypostatic pneumonia. If well fitted, they are not uncomfortable, and within 3 months they do not cause permanent stiffening of joints. The skill required for their proper application seems more difficult to attain than ordinary proficiency in "cut and sew" surgery. The requirements for the nursing care of a single spica are mandatory, but simple enough to be learned by the relatives of a patient within a few days. An overhead frame is essential, to allow the patient, with the help of his free leg, to ease his own position in bed. The patient must be turned on his face for an hour twice a day. This maneuver may be performed with the help of one attendant, always turning over the sound side as an axis, swinging the abducted, encased leg in a high arc, holding the under arm above the head. After one or two days the patient may sit with the injured leg over the side of the bed nearest it, the encased foot on a low stool, the back rest raised high, a pillow behind the opposite shoulder blade, most of the weight on the opposite buttock. In a slender patient in whom the bony prominences may be gripped by molded plaster excellent im-

mobilization of a hip fracture may be assured. Excessive fat, large herniae, colostomies, and suprapubic cystotomies are contraindications to plaster fixation of the hip.

Fig. 4. Subcapital fracture in an 85 year old man, reduced and immobilized in a long single spica for 3 months; union, good result.

With either form of immobilization, if union is going to ensue, it will have progressed sufficiently to allow free motion of the extremity within 3 months and weight-bearing within from 3 to 6 months. Transcervical fractures, being partially extracapsular, are likely to heal somewhat more rapidly and surely than subcapital fractures. No form of weight-and-pulley or spring traction, over whatever type of splint, can possibly provide sufficient immobilization to assure union of an intracapsular fracture with any degree of certainty.

The principal causes of failure of union of these fractures are, (1) aseptic necrosis of the head fragment, inevitable but unpre-

dictable when sufficient destruction of blood vessels has occurred, (2) the size of the head fragment, the smaller the worse the prospect, (3) the direction of the fracture line, the more nearly vertical the more unfavorable, (4) inadequate reduction, (5) inadequate immobilization, by whatever means, and (6) fixed separation of the fragments by metallic agents.

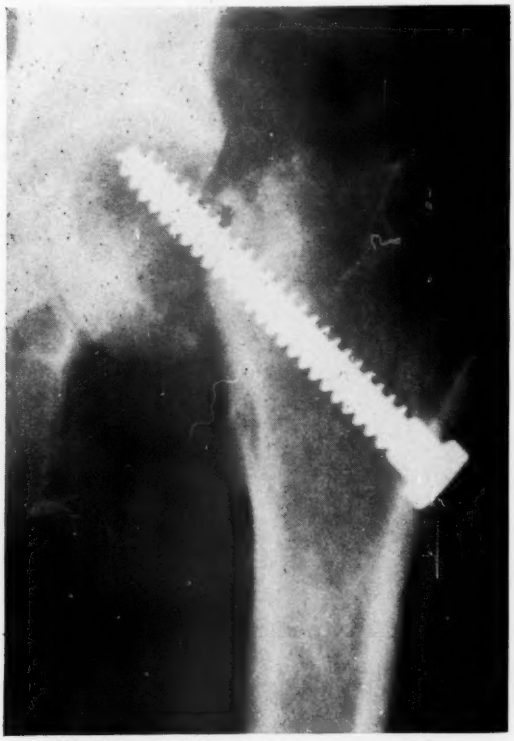

Fig. 5. Failure following use of Lorenzo screw.

Manipulative reposition of fragments and fixation by either internal hardware or external plaster will seldom succeed after a delay of 3 months. High subtrochanteric osteotomies, either sliding or angulating, are useful in converting fibrous unions to bony unions. Central bone grafts require a young patient, a long neck fragment, and a live head. Most frank non-unions, certainly all those with dead heads, are best treated by some type of reconstruction in which the head is removed.

Fractures through the base of the neck, between the trochanters,

and immediately below the trochanters, may all be classified as pertrochanteric fractures. This series includes 31 fractures about the trochanters, of which 4 were basal, 24 were intertrochanteric, and 3 were subtrochanteric.

Of the 4 fractures of the base of the neck, 2 were immobilized

Fig. 6. Same as 5, after modified Whitman reconstruction; good function.

by plaster and 2 by internal fixation. One of the plaster cases had an excellent result; the other was badly reduced and achieved union only with overriding and valgus. The latter case would have been nailed if the patient had not had an active bone infection lower in the same extremity. The third was fixed with a vitallium Jewett nail-plate, with no plaster; this patient walked in 2 months and had an excellent end-result. The fourth was fixed with a Moore blade-

plate; its bearer achieved union in good position, her walking limited by severe Parkinson's disease. There were no deaths.

Of the 24 intertrochanteric fractures, 2 were undisplaced, 22 were reduced. Most of the reductions were performed under general anesthesia, usually sodium pentothal. Three linear fractures, with external rotation deformity only, in old women in frail health, were reduced slowly and carefully on a fracture table with only an opiate.

Fig. 7. Typical intertrochanteric fracture.

One fracture, undisplaced, was treated by bed rest only. Eighteen were immobilized in single long spicas, with the thigh in moderate abduction and moderate internal rotation. The infant was put up in a long double spica of the "push-pull" type, with moleskin adhesive traction incorporated at the ankle on the fractured side and counter-traction exerted through the sole of the foot on the sound side. One adult was encased in a double spica extending to the

knee only on the sound side. Two fractures had open reductions, with fixation by Jewett nail-plates, with no plaster.

The anatomic results were classed as excellent or good in 22 cases and as fair in 2. All plaster spicas were removed in from 4 to 6 weeks, usually in about 30 days. All patients who survived their fractures resumed walking in from 30 to 60 days from the dates of their fractures, unless prevented by other factors, such as extreme senility, arthritis, or Parkinson's disease.

Fig. 8. Same as 7, reduced by abduction and internal rotation, immobilized in long single spica for one month; excellent result.

The infant rapidly achieved a normal extremity and 13 adults are known to have resumed active, normal lives. Two patients were transferred to distant hospitals immediately after their reductions, so that their results are unknown. Four patients died within periods of from 3 to 6 months, after recovery from their fractures and of causes unrelated to the fractures. Three patients died within 30 days, of causes possibly related to their fractures; one died suddenly after 3 days, probably of massive pulmonary embolism, one

died at home after 30 days in a double hip spica, probably of hypostatic pneumonia induced by deficiency in nursing care, and one died after 30 days in the hospital, after removal of her single spica and x-ray evidence of union, of senility and urinary infection.

The 3 subtrochanteric fractures all occurred in males. Two had fallen from heights, and one was a pathologic fracture through a carcinomatous metastasis. The pathologic fracture and one of the traumatic fractures were put up in single spicas, the third was fixed

Fig. 9. Intertrochanteric fracture in which the obliquity runs in the opposite direction, and which requires internal fixation.

with a Jewett nail-plate only. Two had excellent results, walking after 6 and 8 weeks respectively. The one with carcinomatosis died in 3 months, after x-ray evidence of union of his pathologic fracture in 6 weeks.

Summary

Pertrochanteric fractures are all extracapsular; they are all situated in spongy bone; they all heal rapidly. They are all likely to

be comminuted, frequently much more so than the primary x-rays indicate. The diagnostic clinical signs common to all are pain, tenderness, shortening, usually external rotation, and usually adduction. The shortening, due to both overriding and angulation, is likely to be greater than in fractures higher in the neck. Overriding is frequently greatest in vertical fractures through the base of the neck. The typical intertrochanteric fracture line runs upward and outward from the lesser to the greater trochanter. It may

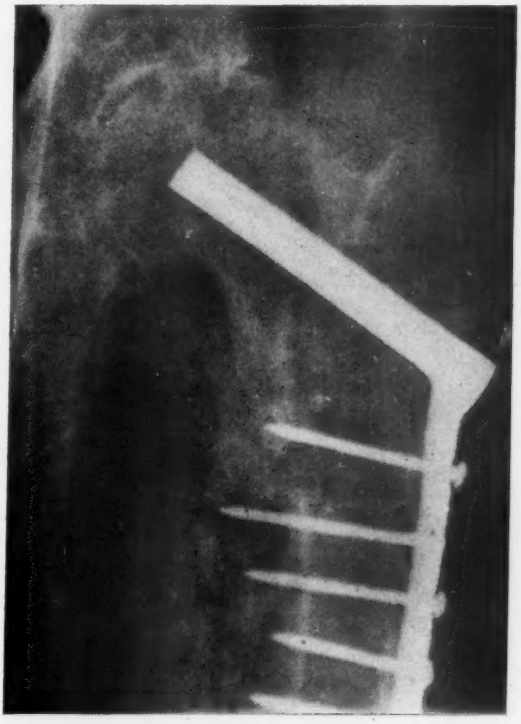

Fig. 10. Jewett appliance in subtrochanteric fracture.

open up only in front, and thus produce only external rotation deformity of the extremity. Separate fracture with wide separation of the lesser trochanter is common; its anatomic reposition is not essential to bony union and good function.

Most pertrochanteric fractures can be adequately reduced by closed manipulation and adequately maintained in single long plaster spicas. The double spica multiplies the problems of nursing care and invites decubitus ulcers and hypostatic pneumonia; an adult in a

double hip spica is about as helpless as a turtle on its back. Routine reduction is best performed under general anesthesia on a good fracture table, using mechanical traction, abduction, and internal rotation, assisted by manual manipulation of the greater trochanter. X-ray check-up is essential before fixation by either external or internal means; in many intertrochanteric fractures an anteroposterior view is sufficient.

The general contraindications to the use of a single plaster spica in these fractures are the same as those listed for intracapsular fractures. Locally, the location, the direction, and rarely the multiplicity of the fracture lines may make their immobilization by external support impractical. With a vertical fracture at the base of the neck the shaft will ride upward inside any plaster cast. And in the rare intertrochanteric fracture in which the principal obliquity runs upward and inward rather than upward and outward abduction serves to increase rather than to reduce the deformity.

With the fracture in which reduction cannot be maintained by a single spica one is left with the choice between some kind of continuous traction and internal fixation. All traction apparatuses are objectionable because of the inadequacy of fixation provided, the discomfort caused the patient, the mechanical and nursing supervision required to keep them working, and the prolonged hospitalization required. If the patient is even a fair operative risk internal fixation is to be preferred. The ordinary Smith-Petersen nail is seldom adequate; the upper end of the shaft is likely already to be comminuted, and in any case its thin outer cortex is insufficient for grasping the base of the nail. Some type of nail or blade is needed which has a plate attached at a suitable angle for screw fixation to the shaft. The penetrating portion need not be as long and its introduction need not be as accurate as for intracapsular fractures. Two piece arrangements, such as a plate fixed to a Smith-Petersen nail by a stud, are liable to work loose inside the wound. The author prefers the Jewett apparatus, a perforated three-flange nail with a plate projecting at an angle from its base, cast of vitallium in one piece. With anywhere near accurate placement of this apparatus no external support is required, union proceeds rapidly, and the metal need never be removed.

There is a recent trend among surgeons toward open reduction and internal fixation of all pertrochanteric fractures. The excuse for operation most commonly advanced is the elimination of the plaster spica. This author is convinced that the inconvenience of a single spica for one month does not justify the added risk of an open operation, and for the present at least, he will continue to

open only those fractures which cannot be adequately reduced and maintained by external means.

Concurrent with this series of fractures of the upper end of the femur there were 6 cases of traumatic dislocation of the hip, 5 of them with associated fractures of the posterior rim of the acetabulum. Two boys, 13 and 16, received their injuries in football. One adult, a laborer of 52, fell from a ladder. Three adults were hurt in head-on automobile collisions in which the knee against the dashboard acted as the counter-force.

Fig. 11. Typical posterior dislocation with small marginal fracture; thigh flexed, adducted, and internally rotated.

The older boy had no associated fracture. His dislocation was reduced promptly, he wore a single short spica for 3 weeks, refrained from weight-bearing for 5 months, and came out with a normal hip. The younger boy's diagnosis was missed, although he was examined by a qualified pediatrician soon after his injury. Six weeks later his reduction required a difficult open operation, and

his end-result is a painful, moderately stiff hip. Two of the adults, reduced promptly and immobilized in long spicas for 3 weeks, attained normal hips, the laborer returning to hard work in 5 weeks. One adult's diagnosis was missed in spite of typical deformity and x-ray examination at a hospital. Closed reduction was effected 2 weeks later, but it took him a year to attain 90 degrees of flexion and his hip is not normal. In one case, a young adult male, primary manipulative reduction, attempted within 2 hours, was effected only with great difficulty. He had an excessive amount of pain during the next week. Six weeks later, during an attack of influenza, he developed a staphylococcus abscess in the resolving hematoma. This was drained through a posterior (Ober) incision, and a major loose fragment of acetabulum was removed. The hip drained intermittently during the next 3 months. A year later he had only 30 degrees of motion. He is now a fit subject for a cup arthroplasty.

Summary

The cardinal signs of posterior dislocation of the hip are shortening and fixation in flexion and adduction. The pain in dislocations is generally greater than in fractures. An x-ray is necessary to determine the extent and location of associated fractures. If prompt reduction is desirable in fractures it is imperative in dislocations. Reduction requires a general anesthesia and full relaxation. The combination of cyclopropane and intercostrin is ideal. The prone position makes reduction easier. With the flexed thigh over the edge of the table, the knee flexed 90 degrees, and the dorsum of the foot supported on a chair, the head will sometimes fall into place. Gentle rotation of the femur, using the flexed leg as a lever, assists reduction. Strong traction can be exerted by the operator's foot in a loop of muslin passed over the flexed calf, leaving his hands free for manipulation. Minor fractures of the acetabular rim usually fall into place without becoming interposed within the joint. Late cases may require open reduction, following which the results are likely to be less than good.

THE SURGICAL RELIEF OF INTRACTABLE DYSMENORRHEA

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SINCE 1895 attempts have been made to relieve the pain of menstruation by operations upon the autonomic nervous system. Cotte[1] in 1924 was first to resect the presacral nerve for intractable dysmenorrhea. The operation was highly successful in that practically all of his patients were relieved of their severe dysmenorrhea. The procedure was reported and many other operators were able to substantiate his results. Cotte wisely emphasized certain types of cases in which relief might be expected, namely, those of uterine dysmenorrhea. It is useless in cases of lumbar backache, ovarian dysmenorrhea and intermenstrual ovulation pain.

Dysmenorrhea, it must be remembered, is a symptom and not a disease. There are two types of dysmenorrhea, namely, primary functional, or intrinsic, dysmenorrhea for which no organic lesion can be found, and secondary dysmenorrhea, or that due to some evident organic lesion in the pelvis. It is in the first class of primary or functional dysmenorrhea that presacral sympathectomy is indicated, those cases in which, after careful survey, pathology, pelvic or remote, sufficient to cause the pain cannot be demonstrated.

What is the cause of pain in primary or functional dysmenorrhea? Primary dysmenorrhea is usually not congenital but acquired. At puberty and for a few years thereafter the menstrual function is usually normal and painless. Then for some unexplainable reason there develops excruciating pain with each menstrual period. Many theories have been advanced to explain the cause of the pain of primary dysmenorrhea. Chief among them are: *Stricture of the cervix* and *malposition of the uterus*. Actual structure of the cervix sufficient to obstruct the menstrual flow does exist but is quite rare. Acute angulations of the body of the uterus on the cervix exist but are rarely sufficient to produce pain. If a uterine sound will pass through the cervix then there is no obstruction to the menstrual flow. *Endocrine imbalance* or *dyscrasia* has been a popular theory. Results of the administration of hormone products have been disappointing. *Constitutionally inadequate and hypersen-*

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sitive types of individuals suffer more pain than do their more stable sisters. Under this heading are included those emotional hypersensitive type individuals with a lowered threshold to pain. It is a fact that all individuals do not bear pain in the same manner. Psychoneurosis predisposes to dysmenorrhea. Sedentary occupations, the anemias, chronic diseases predispose to dysmenorrhea. Much can be done for this type patient by proper medical, hygienic and psychological advice. However, even after proper and adequate treatment many continue to suffer. *Uterine hypoplasia* is a definite cause of primary dysmenorrhea probably due to a pluriglandular dysfunction. Cotte has explained the pain of primary dysmenorrhea as due to a neuritis of the pelvic sympathetic nerves. This observation was confirmed by Davis. Most cases of primary dysmenorrhea will come under one of the above headings. However, there are those who in spite of all treatment continue to have pain and are incapacitated each month. It is in this group that presacral sympathectomy is indicated.

Although our knowledge of the physiology of the sympathetic and parasympathetic nerves in regard to the function of the pelvic organs is inadequate, a few facts are known. Sensory or pain stimuli are transmitted by the sympathetic presacral nerve. Meigs[2] states it also causes "vasoconstriction and inhibition of the musculature of the sigmoid, rectum and bladder and causes ejaculation and contraction of the involuntary sphincter of the bladder. The parasympathetic works in opposition to the sympathetic nerves and causes vasodilation and release of the various sphincters." From a physiologic standpoint then the operation is sound since resection of the sympathetic nerves will increase the circulation and release the muscle spasm in the uterus. Bickers[3] has demonstrated that uterine muscle spasm occurred in 100 per cent of his cases of primary dysmenorrhea. This percentage is very high but it shows that muscle spasm does exist in dysmenorrhea.

The anatomy of the presacral nerve and the operative procedure for its removal have been adequately described by many authors—Greenhill,[4] Meigs, etc. Briefly the presacral nerve lies in a triangle, the apex of which is the bifucation of the aorta and the base of which is a line uniting the two common iliac arteries at the level of the sacral promontory. The nerve will be found lying in a loose areolar tissue on the lower third of the body of the 4th lumbar vertebra, its intervertebral disc and the body of the fifth lumbar vertebra. The excision of the nerve is not difficult in most cases. The posterior peritoneum over the triangle described above is incised at the sacral promontory. The nerve is located and dissected

from its bed in the loose areolar tissue. The upper portion of the nerve lies over the aorta and the lower portion over the bony sacrum separated from them only by the loose areolar tissue. A ligature carrier is placed under the nerve and it is dissected loose from its bed. Just below the promontory of the sacrum the presacral nerve divides into two hypogastric nerves. At least 2 to 3 cm. of each hypogastric nerve must be resected. The resection should be carried as high on the aorta as is indicated. The resected portion of the nerve should measure 6 to 7 cm. The tissue should always be sent for pathologic examination to determine if the nerve has been resected.

Resection of the presacral nerve should be performed on relatively few cases of primary dysmenorrhea. This procedure requires laparotomy and all laparotomies carry some mortality and morbidity. The operation should be reserved for those cases which have proved refractory to all other methods of treatment. The operator must satisfy himself that the patient has been diligent to carry out all other more conservative measures advised. If he is satisfied of this fact, then the case may be considered as intractable and suitable for presacral sympathectomy.

Since 1935, 15 presacral sympathectomies have been performed by one of us for dysmenorrhea. This very small number is due to a careful selection of cases. The operation is advised only after all other procedures fail. With dysmenorrhea of such magnitude as to cause the patient to be incapacitated each month, the diagnosis of primary uterine dysmenorrhea is relatively sure. In 14 cases no other operative procedures were performed save the removal of the appendix. Of the 15 cases, 13 were for primary dysmenorrhea. One was for severe cystalgia and one for dysmenorrhea and endometriosis. Twelve of the 13 cases of primary dysmenorrhea have had complete relief of pain of from 11 years to 4 months. One case got no results. On microscopic examination of the tissue removed at operation no evidence of nerve tissue could be found: thus the poor result was due to an error in technic. The case of severe cystalgia and dysmenorrhea was a woman with severe pain and strangury in the bladder. Complete urologic study and pelvic examination revealed no cause for the pain. She was a morphine addict and the addiction, according to her family physician, was due to the bladder pain. During her stay in the hospital following sympathectomy she did not complain of the bladder pain. However, she still required large doses of morphine. She was to go to an institution for the treatment of her drug addiction. She has not been heard from since, so the results are unknown. Although physi-

ologically the operation is sound it is not recommended for this type of case. The case of recurrent endometriosis was operated upon 6 months ago, this being her second operation for endometriosis. She was desirous of having children. A large endometrioma was removed from the left ovary and the presacral nerve resected. She menstruates normally and has only slight discomfort at her menstrual period. The operation is not recommended for endometriosis, but in this case, with recurrent endometriosis, severe dysmenorrhea and a strong desire to preserve the child-bearing function, conservative measures on the pelvic viscera, with presacral sympathectomy to relieve the pain seemed justified. Of the 13 cases of primary dysmenorrhea, 7 had had previous operative procedures for the relief of dysmenorrhea: 3 had one dilatation and curettement; one had 2 dilatations and curettements; 2 had had dilatation and curettement and suspension of the uterus; one had removal of a cyst from the right ovary. There were no postoperative complications; no effects were noted on the bladder or rectum. Three patients noted some change in the menstrual period. In each case it was prolonged from 1 to 3 days. There were no deaths. Two patients have become pregnant: both have been delivered of normal children without complications.

The female pelvis is probably the most surgically abused portion of the human anatomy, save possibly the appendix. On this premise and since we have the final results of so much useless pelvic surgery, we are loath to advise another procedure upon the female genitalia. Too often is the scalpel substituted for a searching history and general physical and laboratory examination. However, our results in this small series, and those of other authors with much larger series, have been so uniformly good that we feel it worth while to report these results.

Summary

1. The reports in the literature of the results of presacral sympathectomy since Cotte first reported the operation in 1924 have been uniformly good.

2. The etiology of the pain of primary dysmenorrhea cannot always be determined. Many factors may be involved.

3. From a physiologic standpoint the operation is sound.

4. The anatomy of the presacral nerve is such that it is readily accessible for surgical removal.

5. Fifteen presacral sympathectomies are reported, 13 for primary dysmenorrhea, with relief of pain in all.

6. The operation is to be reserved for those intractable cases refractory to all other treatment.

7. With more thorough and painstaking history, physical and laboratory examinations surgery of the female genitalia can be reduced.

REFERENCES

1. Cotte, G.: Resection of Presacral Nerve in Treatment of Obstinate Dysmenorrhea, Am. J. Obst. & Gynec. *33*:1034-1040, 1937.
2. Meigs, J. V.: Excision of Superior Hypogastric Plexus (Presacral Nerve) for Primary Dysmenorrhea, Surg., Gynec. & Obst. *68*:723-732, 1939.
3. Greenhill, J. P., and Schmitz, H. E.: Sympathectomy for Intractable Pain in Inoperable Cancer of Cervix, J. A. M. A. *101*:26-29, 1933.
4. Bickers, W.: Primary Dysmenorrhea, South. M. J. *36*:192-198 (March) 1943.

RESULTS IN GALLBLADDER SURGERY

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RESULTS in biliary surgery during the past decade show generally an improvement over those of earlier years. This paper deals with some of the details which are important in gallbladder surgery, with references to results reported in the literature.

A summary is included of results personally obtained with operation in 200 cases of nonmalignant biliary tract disease as encountered at a private hospital* from 1937 to 1947.

TABLE 1

200 Cases, Acute and Chronic			Deaths 5	(2.5%)
Chronic	172	86%	Deaths 3	(1.7%)
Acute	28	14%	Deaths 2	(7.1%)
Acute with Stones	27	96.4%		
Total with Stones	187	93%		
Cholecystectomy	199 Cases			
Cholecystostomy	1 Case			

Acute cases are so classified on the basis of clinical and operative findings.

Operation for uncomplicated chronic cholecystitis presents few problems comparatively speaking. Sanders[1] reported a mortality of 2.5 per cent in 528 cases operated upon for chronic cholecystitis; our smaller group of 172 gave a mortality of 1.7 per cent. (See Table 1.) Mortality figures for surgery of acute and chronic gallbladder disease, combined, are higher. This series (Table 1) had an overall mortality of 2.5 per cent in 200 cases. Sanders reported 4.1 per cent overall mortality in 803 benign cases. Skjold[2] reported 5.8 per cent mortality in 561 biliary tract operations. Heyd[3] reported a mortality of 7.7 per cent in 3,986 biliary tract operations.

From the surgical standpoint, it is well to regard stone formation as a part of cholecystitis. It is well known that removal of non-

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stone containing gallbladders results in failure to relieve symptoms frequently, while removal of gallbladders containing stones usually results in cures. The high percentage of acute cholecystitis associated with cholelithiasis generally needs no further elaboration. Our 28 acute cases showed 27 with stones, 96.4 per cent; the overall series showed 187 with stones present, 93 per cent.

Just as most cholecystitis deserving of operation will be accompanied by stones, so will most cholecystitis deserving of operation show either stones or a non-functioning gallbladder by properly performed and properly interpreted x-ray studies. Unless clinical evidence is strongly indicative of cholecystitis, a single x-ray report of a non-visualizing gallbladder should be checked by repeating the x-ray studies.

Acute cholecystitis is a disease fraught with difficulties and controversies concerning its management. It is becoming evident[13] that fundamentally, cholecystitis is a metabolic disease in which chemical and mechanical factors combine to produce repeated acute attacks characterized by vascular changes in the gallbladder. These vascular changes vary from mild congestion to gangrene. The process is a progressive one so that the risk and mortality in cholecystitis roughly parallels its duration, being noticeably higher in persons past 50 years of age. Infection may or may not be present. For example, Drennan[4] found 81 per cent of 100 cultures taken from acutely inflamed gallbladders sterile. The gallbladder may harbor any of the organisms normally present in the intestinal tract. When bacterial infection is present in cholecystitis, it is a secondary process to metabolic, chemical and vascular changes. This concept of the disease is not unmindful of infection but it leads the surgeon to realize that if the gallbladder is removed early in the acute attack, infection will have had less time to develop. Danger of operation will be correspondingly less. It is practically undisputed that best results have been obtained by surgery performed within 24 hours of onset of the attacks. Graham's[5] results are an example, a mortality of 3.59 per cent in 167 cases of acute cholecystitis operated upon within 24 hours of the onset. Smith[6] reports 5.4 per cent mortality in 92 cases of acute cholecystitis operated upon on the day of admission as compared with 10 per cent mortality in 239 cases operated upon one day to five weeks after admission. Heyd,[8] Heuer[7] and Glenn[8] published significant reports generally bearing out the advisability of early operation. Heuer[7] reports 153 acute cases operated upon with 3.2 per cent mortality. Glenn[8] reports 527 acute cases operated upon with 2.46 per cent mortality. Most patients are not seen by a surgeon at the onset of

the acute attack due to uncertainty of diagnosis and a delaying attitude by medical doctors. The patients in our acute group were admitted from 12 hours to 3 weeks from onset of symptoms—more patients were admitted on the fourth day of the attack. Fifty per cent of the acute cases were operated upon within 24 hours after admission. Mortality in the 28 acute cases was 7.1 per cent. It might be noted that, of the 2 deaths in this group, one had concomitant acute pancreatitis at operation, and the other was admitted 12 days after onset of jaundice in a moribund state, with pneumonia and B. coli septicemia.

TABLE 2

Total Perforations	13	6.5%
Acute with Perforation	9	32.1%
Free Perforation	2	7.1%
Pericholecystic Abscess	3	
Walled Off by Omentum	4	
Chronic with Previous Perforation	4	2.3% of chronic cases
Pericholecystic Abscess	3	
Fistulae	1	(Cholecystduodenal)

Perforation of the gallbladder may result in free drainage into the peritoneal cavity. Two of our acute cases fell into this group, an incidence of 7.1 per cent in the acute cases (Table 2). This is the less frequently encountered but usually serious type of perforation. Acute perforation may result in a pericholecystic abscess or the perforation may be walled off by omentum. Perforation may lead to a stone burrowing into a neighboring hollow viscus producing a fistula. The original perforation may heal, and later at operation, a pericholecystic abscess or fistula will be found with a gallbladder not acutely inflamed. Of our chronic cases 2.3 per cent fell into this group. In one of these cases, the patient was admitted for intestinal obstruction due to a gallstone in the ileum. Harkins[9] reviewed reports by nineteen authors in the literature and concluded that about 13 per cent of acute cases perforate with a mortality of 20.8 per cent. Our series of 13 perforations is marked by the absence of operative deaths.

The patient with acute cholecystitis should be admitted to the hospital as soon as the attack occurs. An appraisal of the patient's

physiologic and operative condition should be made on admission and operation performed as soon as the patient is properly prepared. This should be possible within 24 hours usually. Careful clinical observation should be made frequently in order to evaluate the course of the disease.

Laboratory procedures take second place to clinical observation, and include blood amylase, albumin-globulin ratio, prothrombin level, nonprotein nitrogen, icteric index and liver function tests. Wangensteen suction is indicated if abdominal distention is marked. Administration of intravenous glucose and amino acids should be given as indicated to overcome dehydration, protein deficiency, and diminished liver function. In jaundiced patients, parenteral injection of vitamin K and repeated blood transfusions are indicated to overcome bleeding tendencies due to hypoprothrombinemia. Prompt administration of penicillin or other drugs may be indicated to combat or to prevent infectious complications.

Unless the patient is seen in the first 24 hours after onset, preparation for surgery can rarely be accomplished in less than 12 to 24 hours. Although many acute attacks might be delayed several days with safety, the observation has frequently been made that often there is little correlation between the clinical severity of acute cholecystitis and the pathologic changes actually taking place in the gallbladder. Some apparently mild acute cases perforate without warning. This bears out the need for delay only until the patient is in a satisfactory physiologic condition for operation.

The acutely ill, jaundiced patient with gallstone obstruction presents the most difficult problem. The most dependable sign of a progressive process with impending perforation is continued or increasing abdominal pain and rigidity.

The operation of choice in acute cholecystitis is cholecystectomy. In our series only one cholecystostomy was performed (Table 1). Mortality figures for cholecystostomy are almost invariably higher than those for cholecystectomy. Heyd[3] reported a mortality of 28.8 per cent in 45 cholecystostomies for acute cholecystitis compared with a mortality of 8.8 per cent for 517 cases with cholecystectomy. In 65 cases with cholecystostomy for chronic cholecystitis, Heyd reported 33 per cent mortality. Heuer[7] concluded that approximately 50 per cent of patients with cholecystostomy later required re-operation with a mortality of 20 per cent. Pennoyer[10] reports 70 cholecystostomies in acute cases with 18.5 per cent mortality. Whipple, in discussing Pennoyer's paper, stated he had not

done a cholecystostomy in the past 2 years. It is, however, conceded that there are cases in which the patient is too ill for any anesthetic except local, and cholecystostomy may be indicated in such cases. This is borne out by the recent excellent results reported by Glenn,[8] who reports 527 cases of acute cholecystitis with 67 cholecystostomies and a mortality of 12.6 per cent. His series

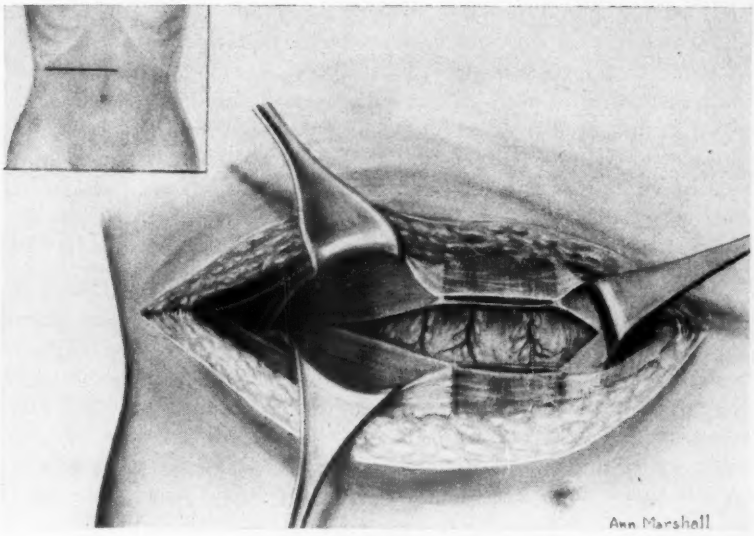

Fig. 1. The transverse incision.

shows a higher percentage of cholecystostomies, 20 per cent, in patients over 50 years of age than in those under 50 years, 9 per cent. His overall mortality of 2.46 per cent for acute cholecystitis speaks well for the methods used.

Exploration of the common duct was done in 18 of our cases, 9 per cent of the total. Stone was found in the common duct in 15 cases, i.e. 83 per cent.

Lahey[11] reports exploration of the common duct, 44 per cent; with stones present, 18 per cent. Glenn[8] reports common duct exploration in 12.6 per cent of 527 acute cases. Heyd[3] reports exploration of the common duct in 7 per cent of 3,240 cases with cholecystectomy, and of the 7 per cent, 86 per cent showed stones.

It cannot be denied that choledochotomy increases the seriousness of a biliary tract operation. Sanders[1] reports 14 per cent mortality with all cases of choledochotomy. His mortality in primary operations with choledochotomy was 9 per cent, compared with a primary

operative mortality of 2.5 per cent without choledochotomy. In our series, 3 deaths occurred in cases with choledochotomy, a mortality of 16.6 per cent for 18 cases.

Re-operation upon the common duct carries a much higher mortality than does primary operation. Heyd[3] reports a mortality of 38.6 per cent for secondary choledochotomy. The generally low

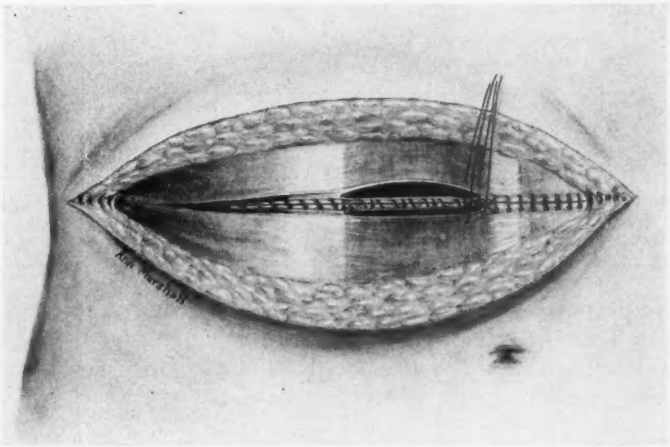

Fig. 2. Illustrates proper closure of transverse upper abdominal incision. The peritoneum and transversalis fascia are closed with continuous catgut, reinforced with interrupted silk or cotton. The aponeurosis and anterior sheath are closed with interrupted cotton or silk. No sutures are placed in the muscle.

incidence of exploration of the common duct, quoted above, indicates that the duct should be opened only when sound surgical judgment is exercised. A dilated common duct in a jaundiced patient suspected of gallstones constitutes one of the strongest indications for exploration of the duct. Stones may be found in a small common duct. Stones may be present in the common duct when not present in the gallbladder. Exploration is indicated in doubtful cases with a history of frequent recurrent attacks of gallbladder colic or jaundice. When the common duct is explored, the hepatic ducts should be searched for stones. Irrigation of the hepatic ducts and the distal portion of the common duct, with saline and a rubber catheter, will frequently reveal hidden stones.

From a technical standpoint, there are several details worthy of attention. Whatever incision is used, it is advisable to obtain adequate exposure so as to visualize the structures about the com-

mon duct. The transverse incision has the advantage of less post-operative pain and fewer wound disruptions.

The incision may be made across one or both rectus muscles as indicated for good exposure. Careful closure of the transversalis fascia and peritoneum lessens the incidence of wound disruption and hernia. In our series (Table 3) 10 wound infections with 8 wound disruptions occurred, an incidence of 5 per cent and 4 per cent respectively.

TABLE 3

Non-Fatal Complications		
Pulmonary	3 (Pneumonia 1, Pleurisy 2)	1.5%
Wound Infection	10	5%
Wound Disruption	8	4%

We prefer to expose the common duct, cystic duct and cystic vessels by blunt dissection and to remove the gallbladder from below. The danger of injury to the bile ducts and right hepatic duct has

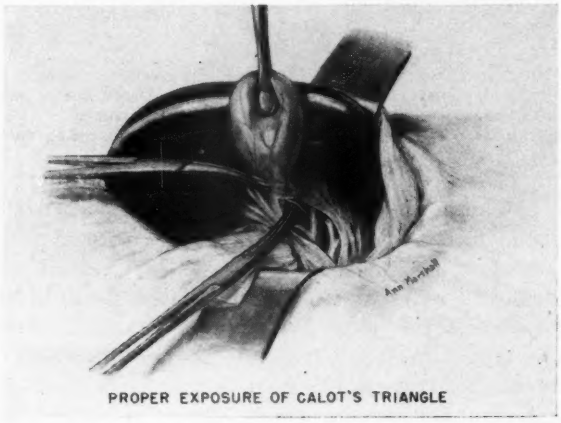

Fig. 3. Calot's triangle is bounded by the common duct, the cystic duct, and the cystic artery normally. The right hepatic artery may serve as a boundary instead of the cystic artery.

been stressed too little. Simon[12] has recently published an article pointing out some of the anatomic variations that might lead to disastrous results. The accompanying illustration adapted from Simon indicates some of the more important variations (fig. 4).

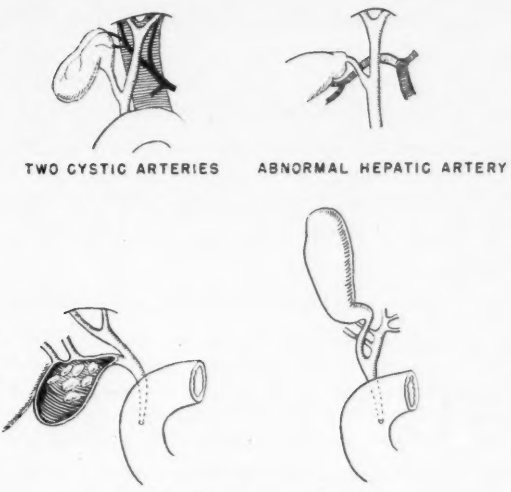

Fig. 4. Anatomic variations. (Adapted from Simon.)

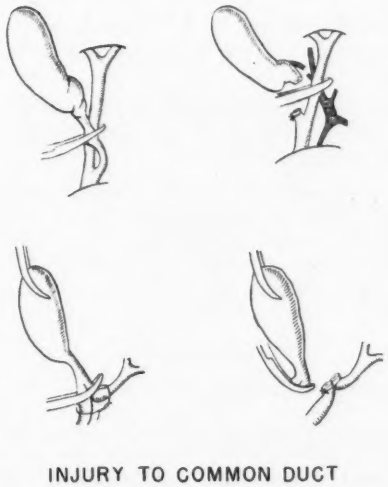

Fig. 5. Illustrates how the common duct may be injured by improper application of clamps.

It is seen that unless the operator recognizes the presence of the right hepatic artery in the position usually occupied by the cystic artery, the right hepatic artery may be divided, leading to liver necrosis and death.

Figure 5 illustrates how the common duct may be injured by clamping a cystic duct which crosses anterior to or posterior to the common duct before joining it. Division of the cystic duct too close to the common duct may lead to a stricture of the common duct.

Postoperative care of gallbladder patients should follow the same principles as are used in preparing the patient for surgery. Early moving in bed and early walking help prevent pulmonary complications. Table 3 shows pulmonary complications in 1.5 per cent of our series.

A summary of the 5 operative deaths in our series follows:

1. A 56 year old male admitted on the twelfth day of illness with jaundice and pneumonia. Developed B coli septicemia. He was operated on 19 days after admission: cholecystectomy with removal of stones from common duct. He developed wound infection and wound disruption, and died on the seventh postoperative day. Autopsy revealed multiple liver abscesses.

2. A 73 year old female admitted 7 days after onset of colic and jaundice. Liver function tests showed marked liver damage. She was operated upon on the ninth day after admission. Cholecystectomy with removal of stones from common duct. She died on the second postoperative day with stupor, high fever and scant urinary output. Possible hepatorenal syndrome.

3. A 53 year old female admitted on the second day of illness, operated upon 2 days later: cholecystectomy. Acute cholecystitis and acute pancreatitis found. She died on the day of operation.

4. A 64 year old female, who had had cholecystostomy 31 years earlier, underwent cholecystectomy, died on the first operative day. Autopsy revealed mitral stenosis with coronary thrombosis.

5. A 55 year old male admitted 5 weeks after the onset of jaundice, operated upon 5 days after admission. Cholecystectomy with exploration of the common duct and removal of stone. Two months later, after discharge and readmission, re-operation with exploration of common duct. He died on the second postoperative day. Autopsy revealed acute pancreatitis and stone overlooked in common duct.

BIBLIOGRAPHY

1. Sanders, R. L.: Surgical Treatment of Cholecystitis, Am. J. Surg. *72*:811-817 (Dec.) 1946.
2. Skjold, A. C.: Surgical Treatment of Gallbladder Disease; Report of 561 Consecutive Cases at Fairview Hospital, Minnesota Med. *29*:1044-1046 (Oct.) 1946.
3. Heyd, C. G.: Factors in Mortality in Four Thousand Operations upon the External Biliary System, Ann. Surg. *111*:820-837 (May) 1940.
4. Drennan, J. C.: A Bacteriological Study of Fluid Contents of One Hundred Gallbladders Removed at Operation, Ann. Surg. *72*:482, 1922.
5. Graham, H. F., and Hoefle, M. E.: Acute Cholecystitis, Ann. Surg. *108*:874-876 (Nov.) 1938.
6. Smith, B. C.: Acute Cholecystitis, S. Clin. North America, 285-300 (April) 1945.
7. Heuer, G. J.: Surgical Aspects of Acute Cholecystitis, Tr. South. S. A. *49*:128-134, 1946.
8. Glenn, F.: Surgical Treatment of Acute Cholecystitis, Surg., Gynec. & Obst. *38*:50-54 (July) 1946.

9. Harkins, H. N., and Cowley, L. L.: Perforations of Gallbladders, Surg., Gynec. & Obst. *77:*661-668 (Dec.) 1943.
10. Pennoyer, G. P.: Results of Conservative Treatment of Acute Cholecystitis, Ann. Surg. *107:*543-557 (April) 1938.
11. Lahey, F. H.: Stones in the Gallbladder and Bile Ducts, Clin. North America *15:*1459 (Dec.) 1935.
12. Simon, M. M.: Pitfalls to be Avoided in Cholecystectomy, Am. J. Surg. *66:*367-381 (Dec.) 1944.
13. Womack, N. H.: The Origin of Cholecystitis, Surg., Gynec. & Obst. *79:*441-444 (Oct.) 1944.

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CANCER OF THE CERVIX

From published reports the salvage in cervical carcinoma is still extremely low insofar as five year cures are concerned. These figures coming from large clinics probably represent a good cross section of the results as their extensive facilities are compensated by the advanced stage of the average cervical carcinoma when first seen by them.

Any increase in the curability rate must come from an early diagnosis which necessarily rests with the first physician who examines the patient.

The work of Papanicolau at Cornell is very interesting but as yet is of little value in cervical carcinoma and the iodine test has been largely discarded. The colposcope merely gives a magnified view of the inspected lesion but is not, in most cases, any more diagnostic than a speculum view of the cervix with a good light.

An early diagnosis, therefore, is almost entirely made by a careful biopsy of the suspected lesion followed immediately by cauterization of the area from which the biopsy was taken.

"A chain is no stronger than its weakest link" is an excellent axiom to apply in cervical cancer, as the pathology of the specimen submitted must be interpreted by a competent pathologist.

In practically all cases irradiation by x-ray and radium is the accepted method of treatment, notwithstanding periodical advo-

cates of the Wertheim or other types of pan-hysterectomy. Any deviation from this plan of treatment places a great responsibility on the individual gynecologist who practices it, regardless of the stage of the disease.

If an individual case is well and thoroughly treated by both x-ray and radium it seems to make no difference whether the x-ray or radium is used first unless pelvic infection is present. Meigs of Boston uses radium first followed by x-ray while the Memorial Hospital in New York reverses the sequel with almost identical results. The Sheffield Clinic in Atlanta advocates in most cases 6,000 milli-currie hours of radium element divided into 2 doses of 3,000 milli-currie hours each at 4 week intervals, followed by deep x-ray therapy 4 weeks after the second radium application. Of course, if pelvic inflammatory disease is present, the x-ray therapy should precede any intra-uterine manipulation.

A Wertheim or other type of pan-hysterectomy may occasionally be indicated in the rare patient who has not yielded satisfactorily to irradiation but should only be done on a diagnosis of an early stage of carcinoma of the cervix made by a competent gynecologist at the original examination and before the use of radium or x-ray and not on the findings at the time hysterectomy is contemplated.

Improved methods of deep x-ray therapy, such as smaller per treatment dosage over longer periods and the use of the vaginal tube are progressive but complicated radium applications have been largely replaced by a proper insertion of the radium salt or emanation in the cervical and uterine canals.

OLIN S. COFER, M.D.

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